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# FINAL ENVIRONMENTAL IMPACT STATEMENT



# REGIONAL FLOOD CONTROL
# TONAWANDA CREEK
# GENESEE COUNTY, NEW YORK



OFFICE OF THE CHIEF OF ENGINEERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C. 20314



NOVEMBER 1981

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Flood management
Tonawanda Creek

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report recommends construction of the Batavia Reservoir Compound modified alternative to provide flood damage reduction in the Tonawanda Creek Watershed, N.Y. The alternative consists of two shallow detention reservoirs (normally dry) arranged in series. The reservoirs would be formed by construction of two earth dams. Each dam would have principle outlet works comprised of side-by-side conduits; five for the upper dam and four for the lower, with dimensions of 11 feet by 11 feet. Each conduit

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would be equipped with an electrically operable gate and provisions for manual operation. The spillways of both dams would be riprapped on the upstream and downstream and crests.

The amount of reservoir flood control storage and operation of the selected plan were developed to meet the planning objectives of the study. The degree of protection afforded by the plan is approximately 500-year in the city of Batavia and variable downstream.

SUMMARY
REGIONAL FLOOD CONTROL
TONAWANDA CREEK WATERSHED
NEW YORK

( ) Draft Environmental Impact Statement (X) Final Environmental Impact Statement

Responsible Office: U. S. Army Engineer District, 1776 Niagara Street, Buffalo, NY 14207. Telephone: 716-876-5454

1. Name of Action: ( ) Administrative (X) Legislative

2. Description of Recommended Action: The recommended Federal project, has an estimated first cost of $25,800,000, and consists of two shallow detention reservoirs (normally dry) arranged in series. The reservoirs would be located on Tonawanda Creek between the village of Alexander and city of Batavia, NY. The recommended plan, known as the Batavia Reservoir Compound (modified) would involve the construction of two earthen dams, each with its own principal and emergency spillways and two reservoirs, the lower reservoir with four training dikes. Snags and debris jams in the main channel of Tonawanda Creek between the two dams would be removed to provide a channel capacity of about 2,000 cubic feet per second (cfs). The two reservoirs embankments and associated lands for flood easements would cover an area of about 5,343 acres between the village of Alexander and city of Batavia. Of this total about 100 acres would be purchased by the Federal Government for construction of the dams and control structures. In addition, about 711 acres of land would be purchased by fee title for fish and wildlife compensation purposes.

3. a. Environmental Impacts: The selected plan would protect human health and life, property, industry, and the environment, by significantly reducing flood damages throughout the Tonawanda Creek Watershed. The upper reservoir would provide about a 10-year flood protection to land located within the lower reservoir. Floods up to the 500-year frequency of recurrence would be detained in the reservoirs from 2 to 8 days longer than under existing conditions. Floods greater than 500-year recurrence frequency would flow over the emergency spillway. Land in the Compound could still be farmed whenever the project site is not flooded. Removal of snags and debris from the channel between the upper and lower reservoirs would insure natural channel capacity of roughly 2,000 cubic feet per second. The Batavia Reservoir Compound would reduce existing tangible average annual flood damages throughout the Tonawanda Creek Watershed, by approximately 74 percent. The economic efficiency of the selected plan, based on an economic life of 100 years and an interest rate of 7-5/8 percent is 1.32. Its average annual benefits are $3,290,500. The evaluation of the discharge of dredged or fill materials into waters of the United States, including consideration of the Section 404(b)(1) Guidelines, has not been completed, and therefore, this Environmental Impact Statement does not include the information required by Section 404(r), Public Law 92-500, as amended.

3. b. Adverse Environmental Effects - About 46 residences, six farmsteads, and one business would be relocated. If these persons relocated outside the

region, regional losses could include minor reductions in the tax base, employment and income. Construction of embankments and dikes for the project would require clearing and stripping of about 126 acres. Also, construction of embankments dikes would require filling in about 44 acres of wetland in the flood plain. Removal of trees, shrubs and herbaceous vegetation during dike and spillway construction would eliminate some existing food and cover habitat used by wildlife. Removal of snags and debris from Tonawanda Creek to eliminate obstacles to streamflow between the upper and lower reservoirs would cause temporary stream siltation and destroy or disturb some aquatic habitat.

4. Alternatives:

No Action
Nonstructural Base Plan
Sierks Reservoir - Linden Reservoir
Sierks Reservoir and Alabama Reservoir Compound
Alexander Reservoir
Batavia Reservoir
Batavia Reservoir and Alabama Reservoir Compound
Batavia Project Modification

5. Comments Received:

| | |
|---|---|
| Great Lakes Basin Commission | 13 May 1976 |
| USDOT, Federal Highway Administration | 27 May 1976 |
| USDI, Bureau of Indian Affairs | 4 Jun 1976 |
| USDI, Bureau of Mines | 4 Jun 1976 |
| Sierra Club, Niagara Group | 7 Jun 1976 |
| U. S. Dept. of Health, Education and Welfare | 8 Jun 1976 |
| Town of Pendleton | 17 Jun 1976 |
| USDI, Fish and Wildlife Service | 17 Jun 1976 |
| USDA, Forest Service | 18 Jun 1976 |
| USDI, National Park Service | 22 Jun 1976 |
| USDA, Soil Conservation Service | 22 Jun 1976 |
| U. S. Department of Commerce | 22 Jun 1976 |
| NYS Department of Environmental Conservation | 24 Jun 1976 |
| USDI, Bureau of Outdoor Recreation | 25 Jun 1976 |
| U. S. Environmental Protection Agency | 25 Jun 1976 |

6. a. Draft EIS to CEQ 30 April 1976.

b. Final EIS to EPA ____________.

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## 1. PROJECT DESCRIPTION

### INTRODUCTION

1.01 Study Authority - Authorization to study the feasibility of flood management in the Tonawanda Creek Watershed, NY, derives from a resolution of the Committee on Public Works, Senate, United States Congress, sponsored by Senator Irving M. Ives, and adopted 15 June 1950, which reads:

> "Resolved by the Committee on Public Works of the United States Senate, that the Board of Engineers for Rivers and Harbors, created under Section 3 of the Rivers and Harbors Act, approved June 13, 1902, be, and is hereby, requested to review the report on Tonawanda Creek, NY, published as Senate Document Numbered 46, Eightieth Congress, First Session, with a view to determining the feasibility of providing flood protection along Mud Creek in Niagara and Orleans Counties, NY."

This authorization was expanded by resolutions of the Committee on Publ Works, House of Representatives, United States Congress, adopted 16 August 1950 and 23 July 1956. Finally, on 5 March 1973, the Chief of Engineers, Corps of Engineers, authorized study of water resources management in the Buffalo Metropolitan Area, NY, and directed that the Study Area include th Buffalo Urban Area (SMSA) and its tributary watershed, including the Tonawanda Creek Watershed. The Chief designated this study area the Buffa Metropolitan Area, NY 44012. Since the Tonawanda Creek Watershed is part of the Buffalo Metropolitan Area, the study of flood management needs in the Tonawanda Creek Watershed has been made as an interim report to the Buffalo Metropolitan Area Study.

1.02 The Problem [1/] - Major flooding has occurred in the Tonawanda Creek Watershed in March 1902, March 1916, March 1942, March 1956, January 1957, March 1960, September 1977, March 1978, and March 1979. The largest flood of record occurring in 1960, caused an estimated $1,500,000 in flood damages. This flood caused damage to 450 residences, 48 commercial units, 250 agricultural units and an undetermined number of roads and public facilities. In general, major flooding occurs in the spring and has been caused by snowmelt augmented by rainfall.

[1/] A detailed description of past floods and flooded areas is contained in Appendix D of this FEIS.

1.03 The Selected Plan [1] - The selected plan to provide regional flood protection on the Tonawanda Creek Watershed is the Batavia Reservoir Compound (Modified). The plan illustrated on Plate 1.1 would consist of two shallow detention reservoirs (normally dry) arranged in series. The plan would involve the construction of two earthen dams, each with its own principal and emergency spillways and two reservoirs, the lower reservoir with four training dikes. Snags and debris jams in the main channel of Tonawanda Creek within the limits of the compound would be removed to provide a channel capacity of about 2,000 cubic feet per second (cfs). The two reservoirs and associated lands for flood easements would cover an area of about 5,343 acres between the village of Alexander and the city of Batavia, New York.

1.04 Project Location - The Batavia Reservoir Compound (Modified) would be located about 67 miles upstream of the mouth of Tonawanda Creek. The compound would be situated on Tonawanda Creek and adjacent lands between the city of Batavia, at its downstream limits, and the village of Alexander at its upstream limits. The entire project is located within the Genesee County, New York. The Tonawanda Creek Watershed and associated floodlands are illustrated on Plate 1.2.

THE UPPER RESERVOIR

1.05 Embankment and Emergency Spillway - The upper reservoir embankment would be located about 200 feet downstream of the Conrail Railroad embankment and would stretch across the Tonawanda Creek Valley for about 5,450 feet. The embankment is designed to function as an emergency spillway with a top elevation of 922.5. [2] About 2 feet of water will flow over the embankment during the Standard Project Flood. The embankment is designed with a 10-foot top width. Along part of the upper embankment the top width will be 20 feet with a 16-foot-wide paved access roadway.

1.06 Principal Outlet Works - The principal outlet works for the upper reservoir consist of a control structure, stilling basin, and an outlet channel. The control structure consists of five-conduit reinforced concrete box culverts with an adjacent inlet flume. Under natural flows, the culverts can pass about 2,000 cfs and up to 10,700 cfs under the 100-year flood conditions when the upper pool reaches 922.5 elevation. Each culvert would be 11 feet high by 11 feet wide and equipped with electrically operable gates. An upstream inlet flume would be constructed to funnel water into the gated conduits.

1.07 Stilling Basin - A reinforced concrete stilling basin, 61 feet wide by 62 feet long would be constructed just downstream of the gated culverts. The purpose of the basin is to reduce the energy of the water discharged from the control structure to tolerable limits.

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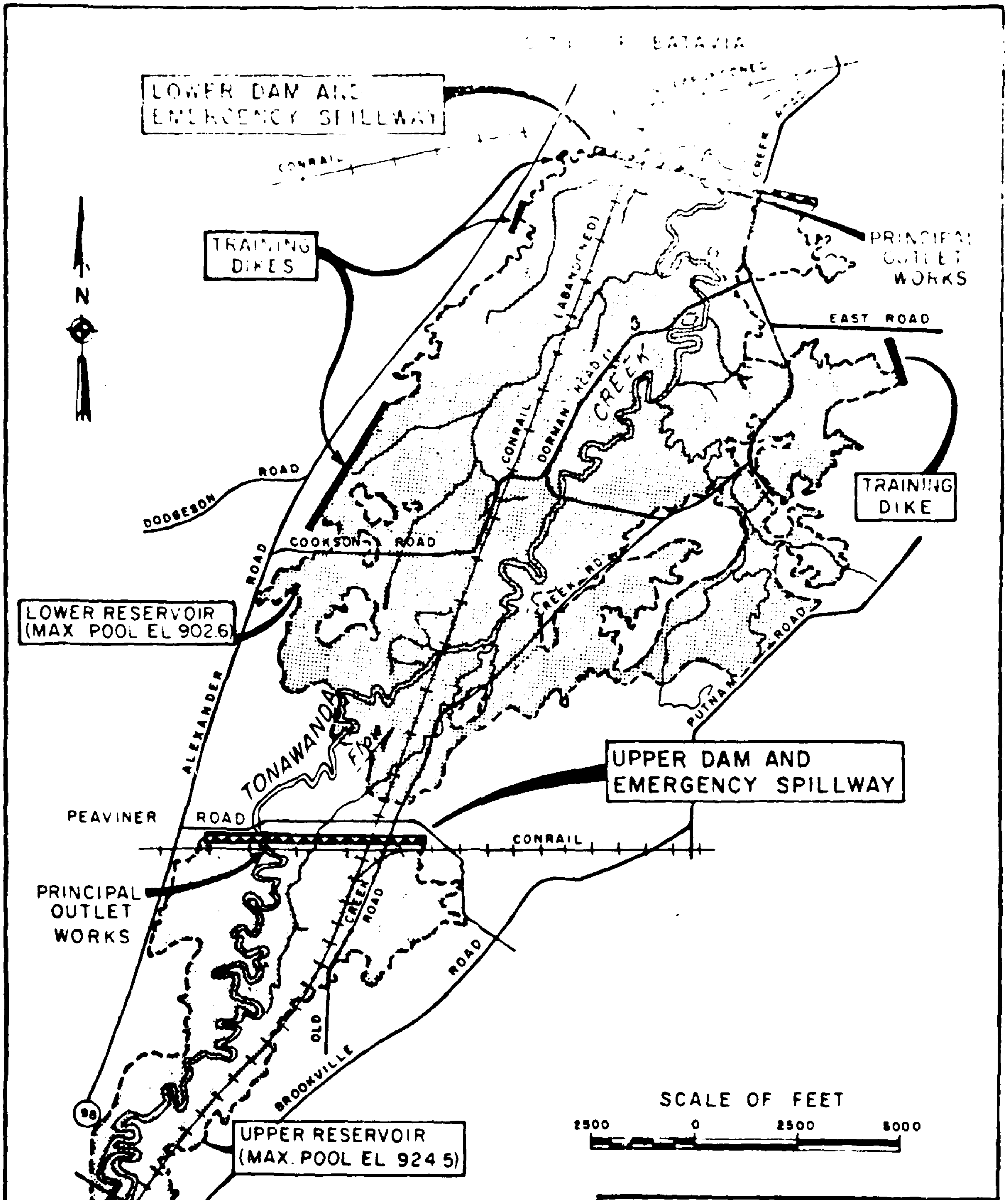
[1] The following paragraphs present a summarized description of the Batavia Reservoir Compound, as modified. The reader who desires a more detailed project description should refer to Appendix D of the Final Feasibility Report.

[2] Feet above sea level.




TONAWANDA CREEK WATERSHED, NEW YORK

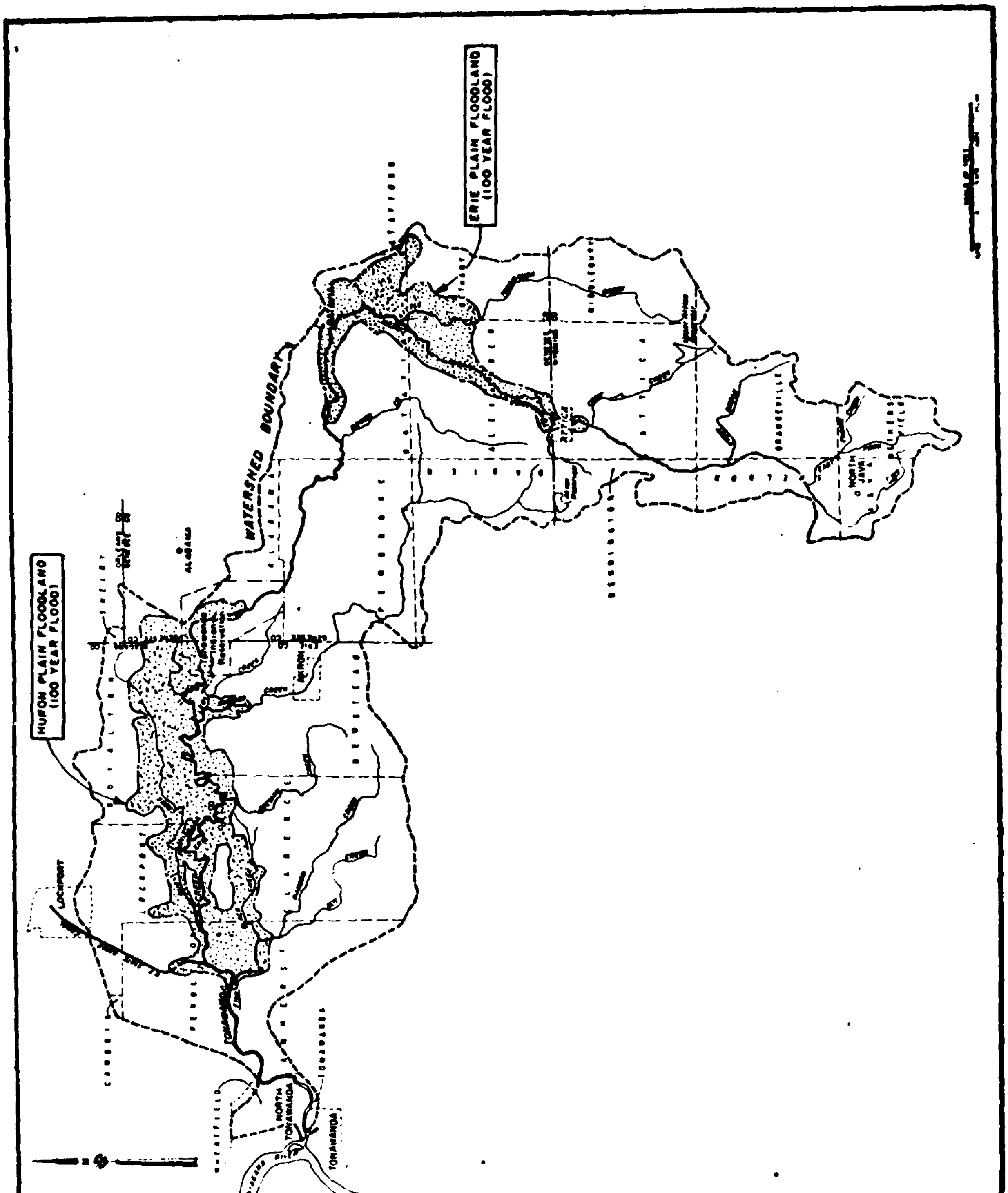
**BATAVIA**

**RESERVOIR COMPOUND**

**(MODIFIED)**

U.S. ARMY ENGINEER DISTRICT, BUFFALO

TO ACCOMPANY REPORT DATED: 1979




Tonawanda Creek, New York

FLOODLANDS



PLATE 1.2

1.08 Outlet Channel - Immediately downstream of the proposed control structure, the Tonawanda Creek Channel is meandering and unsuitable to pass the high flows associated with use of the upper reservoir. A new outlet channel will be excavated from the stilling basin about 1,200 feet downstream connecting with the natural Tonawanda Creek Channel. For the first 100 feet, the new channel will be riprapped and vary from 71 to 91-foot bottom width. For the next 1,100 feet, the channel would be narrowed to 50 feet to form a pilot channel for low flows. The abandoned creek channel would be used as a disposal area for materials collected during various clearing and stripping operations associated with construction of the upper reservoir embankment and from clearing and snagging operations along the existing creek channel in the lower reservoir.

1.09 Access Roadway - A 16-foot-wide paved access roadway will be constructed across the top of the upper embankment. The roadway will run from State Route 98 to Tonawanda Creek, a distance of approximately 1,800 feet. Guardrails will be installed along both sides of the roadway along the emergency spillway, a distance of about 1,550 feet.

1.10 Other Facilities - A small equipment building would be located along the west abutment of the upper embankment. A standby electrical generator capable of operating the upper control structure will be located in this building.

THE LOWER RESERVOIR

1.11 Embankment and Emergency Spillway - The lower embankment would be located upstream from the abandoned Conrail Railroad embankment near the city of Batavia. The west end of the dam would be about 500 feet south of the railroad embankment and the east end about 3,100 feet south. The dam would extend 5,600 feet across the Tonawanda Creek Valley and the west end of the dam would be about 1,000 feet east of State Route 98. The lower dam would be designed to function as an emergency spillway. The spillway section, with crest elevation of 900 feet, would be riprapped and extend westward from Townline Road, a distance of approximately 4,000 feet, and would have capacity to discharge the SPF flood flow. Whatever water passed over the spillway would flow along the course of Tonawanda Creek. The embankment will be of 10-foot top width except where a 16-foot-wide access road is constructed on the embankment. Its width will be increased to 20 feet.

1.12 Principal Outlet Works - The principal outlet works for the lower reservoir consist of a control structure, stilling basin, outlet channel, and inlet channel, all located about 900 feet to the east of the intersection of the lower embankment and Tonawanda Creek. The control structure consists of a four-conduit reinforced concrete box culvert with an adjacent inlet flume. The culvert has the capacity to pass about 6,000 cfs under the 500-year flood occurrence when the elevation of the lower pool reaches 900.0 feet. This equals the maximum possible channel discharge through the city of Batavia. Each culvert would be 11 feet high by 11 feet wide and equipped with electrically-powered gates. An upstream inlet flume would be constructed to funnel water into the gated conduits.

1.13 Stilling Basin - A reinforced concrete stilling basin 48.5 feet wide by 62 feet long would be constructed just downstream of the gated conduits. The purpose of the stilling basin is to reduce the energy of the water discharged from the control structure to tolerable limits.

1.14 Inlet Channel - The natural Tonawanda Creek Channel upstream of the lower embankment will be abandoned and be replaced by a straight inlet channel starting at the upper end of the inlet flume and running upstream for 500 feet where it connects with the natural channel. The abandoned creek channel will be used as a disposal area for waste collected during clearing and stripping operations and from clearing and snagging operations in the lower reservoir.

1.15 Outlet Channel - A new outlet channel, starting at the stilling basin would be excavated for about 100 feet downstream to the junction with the natural Tonawanda Creek channel. The outlet channel will vary in bottom width from 48.5 to 70 feet and will be riprapped along its entire length.

1.16 Training Dikes - Several training dikes would be located along both the east and west sides of the Tonawanda Creek Valley at locations ilustrated on Plate 1.1. The purpose of the dikes is to prevent floodwaters held in the Batavia Reservoir Compound from passing through natural drainageways inundating areas adjacent to the reservoir. A gated culvert will be constructed through each dike to provide the necessary interior drainage. Along the east side of the lower reservoir, a dike would run for 950 feet across a natural saddle in the Tonawanda Creek Valley. Along the west side of the lower reservoir, three dikes would be located about 500 feet east of Route 98 in the area between Cookson Road and the former Lehigh Valley Railroad embankment. These dikes would run for about 3,300 feet, 600 feet, and 150 feet across low areas to prevent possible overtopping of Route 98. Each dike would be designed as a nonoverflow section with a top elevation of 905.5 feet and grassed slopes. The maximum height of the dikes would range from 5.5 feet to 9.0 feet, and have a 10-foot top width. The culvert through each dike would consist of a 24-inch to 36-inch reinforced concrete pipe, reinforcing concrete headwalls and wingwalls, and automatic flap gates mounted on the reservoir side of each dike.

1.17 Access Roadway - A 16-foot-wide access road would be provided across the top of the lower reservoir embankment. The roadway will run from Creek Road to Tonawanda Creek, a distance of about 820 feet. The roadway will be paved for light duty traffic and have guardrails along the roadway at the emergency spillway. This access road would provide an easy route for persons operating and maintaining the outlet works of the lower reservoir.

1.18 Other Facilities - The miscellaneous facilities provided with the lower reservoir and dam are similar to those provided with the upper reservoir (paragraph 1.10).

1.19 Clearing and Snagging - The existing Tonawanda Creek Channel within the limits of reservoir compound would be cleared of snags and debris jams. Dead trees along the channel banks and overhanging, partially uprooted trees would also be removed. This work is expected to restore the creek to a

natural channel capacity of approximately 2,000 cubic feet per second near the upper dam, thereby reducing the frequency of minor flooding. The debris removed from the creek channel would be buried in the abandoned sections of the creek channel.

1.20 Operation of the Reservoirs - Under normal flow conditions, both reservoir floodpools would be essentially dry. The normal flows of both Tonawanda Creek and Little Tonawanda Creek would pass through the reservoir areas within their channels. The operation plan requires the removal of snags and other debris jams within the limits of the reservoir compound to prevent lesser flows from overtopping banks and causing floods. The ultimate effect of removal of snags and debris jams is that lands within the compound area would be flooded less frequently than under existing conditions. When the floodpool reaches the crest of the emergency spillway of the upper dam, elevation 922.5, flow through the open gates would be 10,700 cfs. Excess flow would pass over the top of the emergency spillway. The upper dam is designed to contain a floodpool for the 100-year frequency flood and the floodpool would reach elevation 922.5 with the gates open. During a Standard Project Flood, outflow over the emergency spillway would reach a maximum depth of 2 feet. For floods of less than 100-year occurrence and greater than 10-year occurrence, the gates would be operated to control discharges from the upper reservoir at 2,000 cfs, until the reservoir is filled. After this, the gates would be operated to maintain inflow equal to outflow from the reservoir. For floods of less than 10-year frequency, the gates would be operated to minimize downstream flooding.

1.21 The lower reservoir will be operated in a similar manner to the upper reservoir. When the floodpool reaches the crest of the emergency spillway, at 900.0 feet, flow through the gates when fully open will be 6,000 cfs. Excess flow will pass over the emergency spillway. Floods with a 500-year recurrence interval would fill the floodpool to 900 feet with the gates fully open. Above this level the emergency spillway would be overtopped. During a Standard Project Flood, outflow over the emergency spillway would reach a maximum depth of 2.6 feet. During normal summer rainfall events, the gates would remain fully open. During snowmelt and floods less than a 10-year recurrence interval, the gates will be operated to minimize damage in the lower watershed.

RELOCATIONS AND LAND PURCHASES

1.22 Introduction - Due to the large size of the project, a considerable number of relocations, flowage easements, and purchases of property will be needed for construction and operation of the Batavia Reservoir Compound.

1.23 Upper Reservoir - The land to be used for the upper reservoir totals about 1,208 acres of farmland, wetland, and woodlands. Of this total, 50 acres would be purchased for construction of the embankment and outlet works. Flowage easements would be obtained for the remaining 1,158 acres. Flowage easements would allow continued farming within this area but construction of any new structures would not be allowed. No buildings are currently located within this area, but 12 buildings are situated in the headwater

fringe area of the maximum floodpool. These 12 buildings include three town equipment sheds and nine residences. The nine residences will be purchased and removed. The town sheds will remain in place.

1.24 Lower Reservoir - The land to be used for the lower reservoir totals about 4,135 acres of farmland, wetland, and woodland. This land would be protected by the upper reservoir from flooding of up to 10-year frequency near the upper dam, and about 2-year frequency near the lower dam. Flowage easements would be obtained for about 4,090 acres, allowing continued farming within the area but no new building construction. Purchase and removal would be needed for 37 residences and five farms. Fourty-five acres of land would be purchased for construction of the embankment and outlet works.

1.25 Fish and Wildlife Compensation Lands - About 711 acres of lowland forested wetlands and shrub swamp will be obtained by fee title to offset losses to fish and wildlife habitat caused by the construction and operation of the project. The exact location of these compensation areas has not yet been determined. They would probably be nearby the Reservoir Compound, possibly in areas indicated by the NYSDEC on 29 September 1980 (see NYSDEC letter attached to USF&WS Coordination Act Report, Appendix A, Section A-1).

1.26 Bridge Removal - The abandoned Conrail Railroad Bridge, formerly the Lehigh Valley Bridge, over Tonawanda Creek would be removed in order to improve hydraulic conditions downstream of the lower reservoir. The bridge superstructure and abutments would be demolished. In addition, the creek banks adjacent to the abutments would be excavated to stable 1 vertical on 2 horizontal sideslopes.

1.27 Roadway Relocation - A section of Creek Road in the vicinity of its intersection with the lower embankment would require relocation due to embankment construction. Approximately 500 feet of roadway would be realigned vertically in order to cross over the lower embankment. A 24-foot-wide road with 10-foot shoulders and guardrails on both sides would be provided. The roadway would have light-duty bituminous pavement.

OTHER CONSIDERATIONS

1.28 Local Cooperation - In accordance with current Corps of Engineers policy on regional flood management projects, specific items of local cooperation are not required since the project cost and maintenance is completely a Federal responsibility.

1.29 Project Economics - The total estimated first cost of constructing the Batavia Reservoir Compound is $25,800,000, based upon June 1981 price levels. The average annual costs of constructing, operating, and maintaining the project based upon a 7-5/8 percent interest rate is $2,490,000. The average annual benefits are $3,290,500. The B/C ratio based upon an economic life of 100 years is 1.32. Appendix C gives a more detailed description of the project economics for the Batavia Reservoir Compound (Modified).

1.30 Implementation Schedule - The proposed plan would be implemented in accordance with established procedure over a period of years. The established procedure requires that proposed project report be reviewed by higher Corps authorities, State authorities, and Congress. Congress must then authorize the selected plan. Next, the Chief of Engineers must request funds from Congress for advanced engineering and design, and then Congress must appropriate the necessary funds. If funds were appropriated for project implementation, bids for constuction would be invited, and a contract for construction would be awarded. Lands to be used for the project would have to be made available prior to advertisement. Once construction of the project is completed, the Corps would begin operation and maintenance of the project. If the plan were to be expeditiously authorized and funded, construction of the project could be completed within roughly 4 to 5 years after authorization.

1.31 Construction Materials - Construction materials for the embankments would probably be of local origin. The random fill and impervious core should be available at or near the construction site. The riprap, filter, bedding, and transition materials as well as concrete aggregate, are available from quarry operations in the vicinity of the project.

1.32 Operations, Maintenance and Major Repair - Measurements of precipitation and snow cover, and determinations of soil moisture and its state, would have to be made periodically at selected sites in the Cattaraugus Hills, in order to establish the likelihood and probable degree of possible flooding. This information would be used as the basis for operating the Batavia Reservoir Compound. During flooding the principal spillway gates of at least the upper reservoir would have to be regulated. During major flooding, the spillway gates of both reservoirs would have to been regulated. All structural components of the Batavia Reservoir Compound would have to be maintained as constructed. Work to do this would include: periodic mowing of grassed portions of the embankments and training dikes; removal of undesirable vegetation and debris from the various structures; removal of obstructions from the Tonawanda Creek Channel within the project limits; and periodic cleaning, lubrication, and painting of metal components. After major flooding, certain structural repairs, such as the replacement of riprap on the emergency spillway of both dams, might be necessary. Annual operations, maintenance and major repair costs are estimated at $400,000 annually.

1.33 NED and EQ Plans - In order to select the NED and EQ plans, the impacts of the Basic Alternative Plans were considered in conjunction with such criteria as flood management capability, economic efficiency, operational dependability and external flood damage effects, for serving the National Water and Related Land Resources Management Planning Objectives. That Basic Alternative Plan which would provide the greatest average annual net benefit, or return, was considered to be the NED Plan. Accordingly, the selected plan has been identified as the NED Plan. The EQ Plan is the alternative plan that maximizes net contributions to the EQ attributes of a study area and the EQ objectives that have been developed for a study. Beneficial effects on environmental quality are favorable changes in the ecological, aesthetic, and cultural attributes of the natural and cultural resources of the area. Of the numerous alternative plans considered in detail in the Tonawanda Creek

study, none provided overall net contributions to the ecological, aesthetic, and cultural attributes of the Tonawanda Creek watershed. Although all the regional flood control plans considered would provide considerable downstream flood control in the Tonawanda Creek watershed, thereby favorably impacting on areas of ecological, aesthetic, and cultural significance, all have major impacts in the areas where they would be constructed. Therefore, a positive net contribution to the EQ account cannot be confirmed for any of the plans. Considering the relative ecological, aesthetic, and cultural resources impacts of the various plans, the Alexander Reservoir Plan provides a degree of regional flood control while minimizing impacts in the area where it will be constructed. The plan involves construction of a relatively small dam and flooding an area of about 1,000 acres, considerably less area than any of the other regional flood control plans. Therefore, the Alexander Reservoir Plan has the least impacts on fish wildlife and other ecological attributes of the Tonawanda Creek watershed. It also floods about 1,000 acres of land, compared to 4,000 plus acres for most of the other plans, thereby minimizing aesthetic and cultural impacts. For these reasons, the Alexander Reservoir Plan has been designated as the least environmentally damaging plan in lieu of an EQ Plan.

## 2. ENVIRONMENTAL SETTING WITHOUT THE PROJECT

2.01 Introduction - The discussion presented in this chapter has been condensed and updated from the lengthy description of existing environmental conditions contained in Chapter 2 of the Draft Environmental Impact Statement for Tonawanda Creek released in 1976. The reader who desires more information should refer to Appendix E of this Final EIS where Chapter 2 of the original Draft EIS is reproduced in its entirety. The text of this summary will make frequent reference to Appendix E whenever necessary.

### THE NATURAL ENVIRONMENT

2.02 General The Tonawanda Creek Watershed, an area of about 648 square miles, is located in western New York and includes substantial portions of Erie, Genesee, Niagara, and Wyoming Counties and a minute portion of Orleans County. The watershed comprises many tributary watersheds, including those of Ellicott Creek and Bull Creek which join the main stream, Tonawanda Creek, near its mouth on the Niagara River. Because flood management needs in the Bull Creek and Ellicott Creek Watersheds are normally independent of those in the remainder of Tonawanda Creek Watershed, studies of those needs have been accomplished separately in other reports. The area encompasses about 511 square miles and includes the Tonawanda Creek Watershed less the sub-watersheds of Bull and Ellicott Creeks. 1/

2.03 Physiography - The Tonawanda Creek Watershed includes parts of two physiographic provinces; the Cattaraugus Hills south of the Portage Escarpment belong to the Appalachian Upland, while the larger portion of the watershed north of the Portage Escarpment is part of the Erie-Ontario Lowland. 2/

2.04 The flat-topped Cattaraugus Hills, approximately 1,800 feet above sea level, are separated by deeply eroded valleys with relatively steep sides and slopes. This part of the watershed slopes northward toward the Portage Escarpment, a series of east-west striking strata of erosion-resistant bedrock. The escarpment crosses the watershed near the Wyoming-Genesee County line.

2.05 The Erie-Ontario Lowland part of the watershed includes much of the southern Ontario Plain lying between the Portage Escarpment and the Niagara Escarpment to the north. This plain includes two subplains, the Erie and the Huron Plains separated by the east-west striking Onondaga Escarpment.

2.06 The Erie Plain is rolling with moderate slopes. Within the watershed, the plain slopes in two directions. The eastern and greater part of the plain slopes northward from approximately 1,000 feet above sea level near the Portage Escarpment to approximately 800 feet near the Onondaga Escarpment. The western part of the plain slopes westerly from a height of

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1/ See Appendix E, Plate 2.1
2/ See Appendix E, Plate 2.2

approximately 1,000 feet near the Portage Escarpment in the town of Bennington to approximately 700 feet near the Onondaga Escarpment in the town of Amherst.

2.07 The Huron Plain is only slightly undulating with flat slopes. This plain slopes westerly from a height of approximately 650 feet near the Onondaga Escarpment in the Tonawanda Indian Reservation to approximately 600 feet in the town of Tonawanda. The eastern boundary of the watershed in the Huron Plain lies near the western limit of Oak Orchard Swamp.

2.08 There are numerous natural and man-made waterways within the Tonawanda Creek Watershed. The principal natural waterways are the channels of Tonawanda Creek and its tributaries. The major man-made waterways include part of the New York State Barge Canal and the Feeder Canal. Waterways known to have inadequate capacities under high runoff conditions, particularly those in the essentially flat Huron Plain, are described in subsequent paragraphs.

2.09 Tonawanda Creek, the major stream of the watershed, rises in the Cattaraugus Hills in the town of Wethersfield in Wyoming County. From its source, approximately 1,930 feet above sea level, the Creek flows northward approximately 22 miles through deep valleys with steep sides and slopes to enter the Erie Plain near the village of Attica. In this reach, the creek flows rapidly and usually well within its channel. From the village of Attica, the creek continues to flow northward for nearly 20 miles through essentially flat bottomland to the city of Batavia. The creek in this reach flows slowly and often floods during periods of high flow. In the city of Batavia, the creek's channel is turned by erosion-resistant rock formations of the Onondaga Escarpment, and begins to flow westward through the Erie Plain and parallel to the escarpment. The creek in this reach continues to flow slowly and floods frequently during periods of high flow. In the town of Pembroke, near its boundary with the Tonawanda Indian Reservation, the creek breeches the escarpment approximately 2 miles to enter the Huron Plain within the Reservation. From the Reservation, the creek winds approximately 27 miles westward along the axis of the plain to its confluence with the New York State Barge Canal in the town of Pendleton. The channel of this reach contains sluggish creek flows that often floods extensively during periods of high flow. From this confluence, the creek continues to flow westward approximately 12-1/2 miles to its mouth on the Niagara River. This lower 12-1/2 mile reach was improved to serve as part of the Barge Canal; consequently, although the creek flows sluggishly here, it normally flows well within the channel.

2.10 Little Tonawanda Creek, a major tributary of Tonawanda Creek, rises in the Cattaraugus Hills in the town of Middlebury in Wyoming County. From its source approximately 1,280 feet above sea level, the creek flows northward approximately 8 miles through valleys with steep sides and slopes to enter the Erie Plain near the hamlet of Linden. In this reach, the creek flows rapidly and stays within its channel. From the hamlet of Linden, the creek continues to flow northward for about 10 miles along a winding course, through an undulating plain to its confluence with Tonawanda Creek in the town of Batavia near the Bethany-Batavia town line. The channel of this

reach is generally adequate. However, during periods of high flow in Tonawanda Creek, Little Tonawanda Creek often floods near its mouth.

2.11 Ledge Creek, another major tributary of Tonawanda Creek, rises near the crest of the Onondaga Escarpment in the town of Pembroke. From its source, approximately 680 feet above sea level, the creek flows northwestward approximately 4 miles to enter the Huron Plain at the base of the escarpment in the town of Newstead. In this reach, the creek flows rapidly and usually stays within its channel. From the base of the escarpment, the creek continues to flow northwestward approximately 3 miles through flatland to its confluence with Tonawanda Creek in the town of Newstead. Throughout this reach, the creek flows slowly and often out of channel during periods of high flow. Near the base of the escarpment, Ledge Creek receives its major tributary, Murder Creek, which rises in the Cattaraugus Hills in the town of Bennington. From its source, approximately 1,380 feet above sea level, the creek flows northward approximately 5 miles to enter the Erie Plain at the base of the Portage Escarpment in the town of Darien. From the base of the escarpment, the creek winds northwestward for about 25 miles across the Erie Plain to the crest of the Onondaga Escarpment in the village of Akron. From the village of Akron, the creek descends to the Huron Plain to join Ledge Creek.

2.12 Beeman Creek, a minor tributary of Tonawanda Creek, rises near the crest of the Onondaga Escarpment in the town of Newstead. From its source, approximately 740 feet above sea level, the creek flows northwestward approximately 6 miles to enter the Huron Plain at the base of the escarpment in the town of Clarence. In this reach, the creek flows rapidly and usually within its channel. From the base of the escarpment, the creek flows northward approximately 3 miles through flat land to its confluence with Tonawanda Creek in the town of Clarence. Throughout this reach, the creek flows sluggishly and usually out of channel during periods of high flow.

2.13 Mud Creek, a major tributary of Tonawanda Creek, rises near the western periphery of the Oak Orchard Swamp in the town of Royalton. From its source, approximately 600 feet above sea level, the creek winds westward approximately 18 miles through flat land of the Huron Plain to its confluence with Tonawanda Creek in the town of Pendleton. Throughout its length, the creek flows sluggishly and usually out of channel during periods of high flow.

2.14 Ransom Creek, a major tributary of Tonawanda Creek, rises near the crest of the Onondaga Escarpment in the town of Newstead. From its source, approximately 745 feet above sea level, the creek flows northwestward approximately 13 miles to enter the Huron Plain at the base of the escarpment in the town of Amherst. Throughout this reach the creek usually flows within its channel during periods of high flow. From the base of the escarpment, the creek continues to flow northwestward for 4 miles through flat land to its confluence with Tonawanda Creek in the town of Amherst. The creek in this reach generally flows sluggishly and usually out of channel during periods of high flow. Near the base of the escarpment, the creek receives a major tributary, Got Creek, which rises in the town of Clarence and flows northwestward for about 10 miles to its confluence with Ransom Creek.

Approximately 1 mile downstream from its confluence with Got Creek, Ransom Creek receives a second major tributary, Black Creek, which rises in the Huron Plain in Clarence and flows westward 8 miles through flat land to its mouth. Throughout its length, Black Creek flows sluggishly and often out of its channel during periods of high flow.

2.15 Bedrock 1/ - Bedrock of the watershed was formed during the Silurian and Devonian periods of the Paleozoic era. It includes sedimentary formations of the Lockport Group of the Middle Silurian System through the Canadaway Group of the Upper Devonian System. The bedrock at the site of the selected plan includes sedimentary formations of the Hamilton Group. The major part of the project area is underlain by an outcrop of the upper Skaneateles Formation - the Levanna Member: a dark grey shale, with a thickness estimated at around 100-150 feet. The southern upstream section at the site of the selected plan, extending down to 8 miles south of the city of Batavia, is underlain by the Centerfield and Ledyard-Wanakah Members of the Ludlowville Formation. These two units are described as a thin massive limestone bed 1 foot thick and a dark to light grey shale with interbedded limestones - approximately 100 feet thick, respectively.

2.16 The original structure of the bedrock was scoured by Pleistocene glaciation. The softer strata were easily eroded; places formerly occupied by such strata became lowlands. The harder strata resisting erosion are visible today as escarpments. Bedrock strata in the lowlands generally dip 1/2° (48 feet per mile) in a southeastward direction and strike subparallel to the faces of the escarpments.

2.17 A large thrust fault, whose axis runs 1/2 mile west of the site of the selected plan, extends from the hamlet of Linden (southeast of the city of Batavia) to the hamlet of Clarendon (southeast of the village of Albion in adjacent Oak Orchard Creek Watershed). The fault strikes north-south and has a throw of more than 100 feet. Numerous small thrust faults and superficial faults caused by mining of salt and gypsum from the substrata and surface loading, have been found in this part of the watershed.

2.18 Seismicity - According to maps prepared in 1969 by the Environmental Science Service Administration, the Tonawanda Creek Watershed is located in zone where major destructive earthquakes may occur. The most severe recorded earthquake in the watershed, which occurred near Attica in August 1929, had an intensity of VIII on the 12-point Modified Mercali Intensity Scale of 1956.

2.19 Ground Water - A thick outwash deposit of high permeability lies in the Tonawanda Creek Valley south of Batavia. This deposit, containing open-work gravel, has a saturated thickness of 70 feet. At Batavia, these deposits yield 500 to 1,200 gallons per minute (gpm) to properly constructed wells. Downstream of Batavia, most surficial deposits are low permeability

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1/ See Appendix E, Plate 2.3

till and lake deposits. Substantial amounts of ground water (1,000 gpm from individual wells) are located in the Camillus Shale near Akron, but poor water quality limits its use to industrial cooling purposes only.

2.20 Natural Resources [1/] - Bedrock resources in the watershed include four nonmetallic types of rocks-salt, gypsum, limestone, and dolomite. Also, there are five known fields of natural gas. Sand and gravel deposits generally occur in scattered areas throughout the watershed.

2.21 Soils - Soil types in the Batavia Reservoir Compound site belong to the Palmyra Association as described in a report by the U. S. Soil Conservation Service in Batavia, NY, entitled, "Soil Survey, Genesee County, New York." This association is made up chiefly of deep, well-drained, gravelly soils on glacial outwash terraces and of loamy soils on flood plains. It occurs in the southern half of Genesee County, where outwash terraces and the adjacent first bottoms along the major streams are most extensive. In these places there is a considerable difference in elevation between the valley floor and the nearby uplands. The largest area of glacial terraces in the county extends along the east side of the Tonawanda Creek Valley from Batavia to Attica.

2.22 Dominant on the terraces are the gravelly, well-drained Palmyra soils. In addition, there are smaller areas of Phelps, Fredon, Halsey, and Arkport soils. These soils on terraces together make up 65 percent of the association. On the adjacent bottom land are the Genesee, Eel, Wayland, and other alluvial soils. These occupy 20 percent of the association. In the beds of old glacial lakes, the most common soils are the more clayey Rhineback and Madalin soils, and these make up 15 percent of the association.

2.23 In areas having favorable slopes, the soils on terraces are excellent for farming, and so are the Genesee and Eel soils on the flood plains. They are fertile and highly productive. In contrast, the soils in wet lakebeds and those on very steep terraces are poor for farming. Flooding is a hazard on the bottom land. Nonfarm uses of the soils on the bottom land are seriously limited by the risk of flooding. The adjacent terraces offer many excellent sites for homes or industrial plants. Water is available from underground sources, and the soils are sufficiently permeable for disposing of septic tanks effluent. Gravelly material needed in construction can be obtained in most places. [2/]

2.24 Climatology [3/] - The Tonawanda Creek Watershed has a humid, continental type climate. The average annual temperature is 46.6 degrees Fahrenheit. July is the warmest month and January the coldest, with average monthly temperatures of 69.2 and 23.3 degrees Fahrenheit, respectively. The

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1/ See Appendix E, page E5
2/ See Appenndix E, Table 2.A
3/ See Appendix E, Pages E31-36

average annual precipitation is 35.36 inches, varying from a minimum of 2.50 inches in February to a maximum of 3.26 inches in August. The average annual snowfall is 80.6 inches. The nearness of the Great Lakes has a moderating affect on temperatures and influences the amount of precipitation received. The prevailing wind is west-southwesterly in winter and spring, but it is southwesterly to southerly in summer and fall.

2.25 Air Quality - The Air Pollution Control Division of the Erie County Department of Health maintains four continuous air monitoring stations in Erie County. CAM's measure particulates, sulfur dioxide, nitrogen oxides, ozone, carbon monoxide, and weather. CAM's are run continuously and are connected to a centralized data processor. Manual sampling is done periodically for suspended particulates, settleable particles, and sulfation rates. 1/

2.26 Some idea of total suspended particulates (expressed as a geometric mean) in Niagara, Genesee, and Wyoming Counties was obtained from air sampling station data given in the NYS Department of Environmental Conservation "Twelve Month Statistical Summary" for the sampling period January 1974 - December 1974. 2/

2.27 Vegetation - Cursory on-site field observations of vegetation were made in the vicinity of the Batavia Reservoir Compound site by a Corps ecologist during the late fall period 28-29 October 1975. The following general locales were spot-checked: The area north of the steel road bridge over Tonawanda Creek at Route 20; the area north and south of the Erie-Lackawanna Railroad tracks near Tonawanda Creek; the area south of the Lehigh Valley Railroad tracks from its intersection with the Erie-Lackawanna Railroad tracks east to the general vicinity of Tonawanda Creek.

2.28 In general, vegetation within the Batavia Reservoir Compound site consists of cultivated plants used in dairy farming and hardwoods, shrubs, and herbaceous plants that have naturally established in the area. Interspersed over the area are haylands and pastures established with grasses and legumes; fields used for row crops such as corn; bottomland of tree-shrub-weed mixtures bordering many of the aforementioned fields. The tree association most often observed along the peripheral banks of the Tonawanda Creek in this part of the watershed were Eastern Cottonwood, Box Elder, and Black Willow. Scattered wetlands within the Batavia Reservoir Compound site contains either standing water year-round or are intermittently wet; sedges, rushes, cattails, iris, and woody vegetation are generally associated with these wetlands. On some wetland pockets, iris is a dominant successional species along with cattail. 3/ 4/

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1/ See Appendix E, Table 2.F
2/ See Appendix E, Table 2.G
3/ See Appendix E, Table 2.H
4/ See Appendix G for wetland location maps within the Batavia Reservour Compound

## FISH, WILDLIFE, AND BENTHIC MACROINVERTEBRATES

2.29 Introduction - The following descriptions have been summarized from various studies on Tonawanda Creek done by the NYS Department of Environmental Conservation, Biologists from the Corps of Engineers, and the U. S. Fish and Wildlife Service.

2.30 Fisheries - A considerable amount of fisheries data for the entire length of Tonawanda Creek was presented in the original Draft EIS. This data obtained from Fisheries Biologists of Regions 8 and 9 of the NYS Department of Environmental Conservation (NYSDEC) in general indicate that the lower portion of the main stem of Tonawanda Creek is composed primarily of warm water species. Brown trout were found in some areas along the upstream portions of Little Tonawanda Creek. Brown trout are stocked by the NYSDEC at various locations along Tonawanda Creek and Little Tonawanda Creek. Some additional limited fisheries data was gathered by Corps Biologists in December 1975. 1/

2.31 In response to the lack of available fisheries data on Tonawanda Creek in the Batavia Reservoir Compound area the Buffalo District and the U. S. Fish and Wildlife Service contracted for an intensive fisheries study of the area during 1979. The fish survey was conducted in Tonawanda Creek and its nearby tributary streams between 25 June and 20 July 1979. In total, 27 species were collected at sampling stations using various methods. Four game species, Brown Trout (*Salmo trutta*), Northern pike (*Esox lucius*), smallmouth bass (*Micropterus dolomieui*), and largemouth bass (*M. salmoides*) were collected. In the main stem of Tonawanda Creek 20 species were collected. A total of 17 species were collected in Little Tonawanda Creek. Species assemblages varied dependent upon the stream characteristics present at a particular sampling station. In general upstream reaches, swifter water species such as brown trout, fantail darter (*Etheostoma flabellare*), blacknose dace (*Rhinichthys atratulus*), and central stonerolle (*Campostoma anomalum*) were found. In middle stretches smallmouth bass were the most abundant game species, and in downstream, low gradient areas, Northern pike were the dominant predators. 2/

2.32 Wildlife - A number of wildlife species were observed in the Batavia Reservoir Compound site during late October 1975. 3/ In addition, Region 8 of the NYSDEC provided information on additional wildlife species that could probably be found in the project area. 4/ Terrestrial habitats such as cropland, hayfield, pasture, emergent marsh, shrub swamp, and forested wetland support a diverse assemblage of wildlife species in the project area. The U.S. Fish and Wildlife Service surveyed the project area during 1979. The various wildlife species identified for the project area are discussed in the Fish and Wildlife Coordination Act Report (see Appendix A-1).

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1/ Refer to Appendix E pages E42-E50 for data on the fishes collected during these various studies
2/ Refer to Appendix A for a complete copy of the Tonawanda Creek fish survey report
3/ Refer to Appendix E, page E51
4/ Refer to Appendix E, pages E52-E54

2.33 Endangered Species - An updated analysis of possible endangered species occurrences in the Batavia Reservoir Compound has been conducted and is included in Appendix A of this Final EIS.

WATER QUALITY AND BENTHIC ORGANISMS

2.34 New York State Department of Environmental Conservation Water Quality Classifications and Standards - "Classifications and Standards Governing the Quality and Purity of Waters in New York State," (11) dated 27 March 1974, describes the various stream classifications and indicates criteria for water quality in each stream category as to their best use. Beginning with the highest uses the State's fresh surface waters are classified as follows:

| Class | Use |
|---|---|
| N | Enjoyment of waters in their natural condition |
| AA/A | Drinking, culinary or food processing purposes |
| AT | Class A waters that are inhabited by trout |
| B | Primary contact recreation (bathing) |
| C | Fishing and fish propogation |

2.35 Upon coordination with the NYS Department of Environmental Conservation, it was noted that the following classifications have been presently assigned to Tonawanda Creek and Little Tonawanda Creek:

Tonawanda Creek

Class C - Mouth to Barge Canal at Pendleton
Class B - Pendleton to Dam at East Pembroke
Class C - Dam at East Pembroke to Water Supply Dam at Batavia
Class A - Water Supply Dam at Batavia to Source

Little Tonawanda Creek

Class A - Mouth to Pond 16D.
Class AT - Pond 16D at Hamlet of Linden to Hamlet of Dale.
Class A - Hamlet of Dale to Source.

Most of the tributaries to Tonawanda Creek and Little Tonwanda Creek are designated as Class A waters.

2.36 1970 Stream Survey Erie County Department of Health [1] - This survey inventoried the surface waters of 27 streams in Erie County, one of which was Tonawanda Creek. From the samples taken during June, July, and August 1970, on the spot determinations of dissolved oxygen (DO) in the water, the water temperature and percentage of dissolved oxygen were made. Specimen samples were also taken to the laboratory and biochemical oxygen demand (BOD), the phosphate, nitrate, chloride, and fecal coliform content of each sample were determined.

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1/ Refer to Appendix E, page E63

2.37 1973 Erie County Department of Health Survey - During the summer of 1973, an environmental health survey of Erie County was conducted by the Erie County Laboratory, Public Health Division of the Erie County Department of Health. This survey was a followup of the original stream survey done in 1970. Three stations on Tonawanda Creek were sampled, using one of the 1970 sample sites and two new sites. Samples were taken during normal daytime working hours. Where the stream was wadeable, water samples were collected using a one-half gallon jug; where the stream was too deep, either a Kemmerer or Van Dorn sampler was used. Samples were collected approximately three times per week during 1970 summer months and on a weekly basis during 1973 summer months.

2.38 As indicated in the 1973 Erie County Stream Survey - "Mud samples from the bottoms above, at, and below the sewage treatment plant effluent contained the following taxa: Pediastrum, Gyrosigma, Stoneflies, Mayflies, Psephenus, Melosira, Closterium, Cosmarium, Cambarus, Scenedesmus, Navicula, Dictyosphaerium, Euglena, Cyclops, Campeloma, Helisoma, Pentaneura, Tendipes, Gammarus, and tubificids. The latter, tubificids, were tremendously abundant with the Bloodworms (Tendipes) almost as numerous.

2.39 "Total coliform counts averaged 661 with a high pulse at the treatment plant effluent with the fecal coliforms averaging 338 and pulsating at the effluent." This count is really not excessively high but the dilution factor present in the stream is probably responsible.

2.40 "During the 1973 season, 36 percent of the bacteriological samples taken had fecal coliform counts in excess of 300 per 100 ml (not checked in 1972)." One hundred percent of all bottom collections in the Tonawanda Creek contained relatively large numbers of tubificids. Tendipes was the abundant insect larvae at all stations but was overly abundant at the sewage plant outfall. Combining all these data and using the combination as a pollution index, the Tonawanda was the 18th most polluted out of 20 streams studied.

2.41 Station TC-1A (Below sewage treatment plant) - "The water here was over 4 feet deep, had a mud-gravel bottom with a distinct odor of sewage. Tubificids and Tendipes dominated the soft mud with other evidences of a zoogloeal mass present. Vorticella and Carchesium were common stalked protozoa attached to mud and plant particles. Crenothrix and Spaerotilus were entwined about the entire mass."

2.42 Station TC-2 (At the sewage effluent) - "Tubificids were extremely abundant along with Tendipes and a pulse of both fecal and total coliforms indicated the presence of large amounts of organic wastes. Chaoborus, the ghost larvae of a common midge, were abundant as a plankton very close to the mud bottom. This is a deep-water larvae usually found in large numbers where organic enrichment is great."

2.43 Station TC-2A (Above the sewage treatment plant) - "This station was as polluted as that below the effluent indicating that the entire stream contained an excess of protein matter which had not been adequately oxidized. The effluent from the treatment plant had little additional effect on the

stream fauna. Gammarus was an important crustacean on the mud bottoms. It was interesting to note here in the samples the presence of large numbers of the ephipial eggs of Daphnia. Evidently the 'flea' migrates somewhat up the stream from Lake Erie and the Niagara River. There is also the possibility that heavy production of Daphnia takes place in the lower stretches of the Tonawanda Creek."

2.44 A check of available computerized stored data was made to determine what existing water quality data was available on Tonawanda Creek. 1/ One sample station was done at Batavia, NY, in 1971 by the U. S. Geological Survey with data collected on nitrates and nitrites. Additional USGS data exists for Tonawanda Creek at Millersport, NY; sampling at this station was done from April 1974 to May 1975 and includes data on Total Lead, Mercury, Nitrogen, Percent Dissolved Oxygen, Dissolved Oxygen, Total Phosphorus and Total Zinc.

2.45 Marcus and Little (1974) did some investigation of macroinvertebrates during July and August 1971 along Tonawanda Creek in Wyoming County, in the general vicinity between Attica, NY, upstream to just south of Johnsonburg, NY. Scientific names of benthic organisms identified to order, genus and when possible, species that were observed in the survey included: Decapoda (Cambarus bartoni); Coleoptera (Psephenus herricki); Megloptera (Corydalus cornutes); Trichoptera (Cheumatopsyche sp.); Diptera (Chironomus sp., Hexatoma sp., Tabanus sp.), Plecoptera (Neoperca sp., Paragnatina sp., Acroneuria ruralis, Neophosgenophora sp.); Ephemeroptera (Isonychia sp., Stenonema sp., and Tricorythodes sp.).

2.46 A benthic sampling survey on Tonawanda Creek in the vicinity of the Batavia Reservoir Compound site was conducted in March 1976. A report of this survey is presented in Appendix A of this Final EIS.

2.46a Additional water quality data for Tonawanda Creek at Batavia is contained in the 1978 and 1979 water year issues of Water Resources Data for New York Volume 1. New York Excluding Long Island prepared by the U.S. Geological Survey in cooperation with the State of New York and other agencies. Data are provided in both issues concerning water pH, turbidity, hardness, alkalinity, temperature, specific conductance, phytoplankton concentrations, fecal coliform bacteria, fecal streptococci, suspended sediments, dissolved oxygen and solids, calcium, magnesium, sodium, potassium, bicarbonate, sulfate, chloride, fluoride, silica, nitrogen, phosphorus, arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, selenium, silver, and zinc. Bicarbonate and carbonate concentrations are also included in the 1978 water year issue. The 1978 and 1979 Batavia water quality, data for pH, total dissolved solids, and dissolved oxygen fall within the State of New York's quality standards for Class A waters. Due to a lack of data, comparison of additional parameters with the State's Class A water specifications was not possible.

1/ Refer to Appendix E, page E73

## THE HUMAN ENVIRONMENT

2.47 Land Use [2] - Economic growth in the Buffalo urban area, originally stimulated by Buffalo's locational advantage as a breakbulk point for Great Lakes cargo, has induced considerable development in the western portion of the watershed. Towns and villages that were once outside Buffalo have lost their separate identity as suburbanization spread outward from the city. Future estimates of the outer limits of the Buffalo urban area have been liberally estimated by regional and local planning agencies to reach the eastern boundary of the town of Clarence, about 13 miles from the center of Buffalo. This 13-mile radius includes undeveloped acreage in other first- and second-ring suburban towns less distant from the CBD which are also expected to experience their own population growth. Analysis of past and present trends indicate that the process of conversion of agricultural and vacant land to more intensive uses is spreading to the north and east of Niagara Falls in Niagara County and to the north-east and east of Buffalo in

[2] See Appendix E, Plate 2.17

Erie County. A significant factor in establishing these trends was the major highway construction of the 1960's which made these areas accessible to a large commuter population influx.

2.48 Much of the western portion of the watershed is directly in the path of this growth corridor. Vacant land in the Tonawanda Creek flood plain will become increasingly attractive to develop into residential subdivisions. Developments such as the new State University Campus and two planned communities in Amherst, may act as nodal points for future development. Land in the northern portion of Amherst and Clarence adjacent to the creek consist of idle vacant land, or lands actively farmed, either on a full or part-time basis. Large amounts of land have already been taken out of production in this area as a result of land speculation.

2.49 Remaining upstream areas of the watershed are primarily agricultural, however, the Tonawanda Indian Reservation and three extensive wildlife refuges also occupy significant areas in the center of the watershed. A secondary manufacturing, commercial, and institutional growth center is Batavia, which is located in Genesee County.

2.50 Agriculture is the predominant land use in Genesee and Wyoming Counties, although the manufacturing sector accounts for the largest levels of employment. Almost 286,000 acres, slightly less than 450 square miles, within the watershed are farmlands. Of this amount, 108,000 acres are designated by State planning agencies as high viability farmlands. Several agricultural districts, formed in the upper reaches, should help to maintain the future of active agriculture and discourage the conversion of productive land into nonfarm uses.

2.51 Economic and social activity upstream of the Indian Reservation is centered in the city of Batavia. Batavia's geographic location midway between Rochester and Buffalo has been a major factor in its cultural and economic dominance of the surrounding area. The city is located in a rich farm and industrial region and serves as a major center of motor freight service and as a growing wholesale distribution point. The Batavia area is expected to continue its moderate growth rate into the future.

2.52 Transportation - There are approximately 689 miles of improved highways in the watershed, including 50 miles of Federal highway, 239 miles of State highway, 400 miles of county highways. In addition, the watershed contains numerous secondary city and town roads. 1/ Of the major four counties within the watershed, Erie and Niagara Counties are the most densely populated and have the highest concentration of roads. Genesee and Wyoming Counties consist primarily of a farmland, therefore, their road systems are not as extensive as in the downstream counties. However, the road network is adequate to serve the needs of a farm-oriented region.

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1/ See Appendix E, Plate 2.18

2.53 In most of the watershed minor civil divisions, over 80 percent of the daily work trips occurred in private automobiles. 1/ Due to the close proximity of agricultural sources of employment, a relatively high percentage of the working population in Genesee and Wyoming Counties does not commute by automobile. Many workers either walk to their place of employment or work at home. In addition to work trip activities, the watershed's highway system also serves business vehicles used for industrial and commercial, private vehicles used for private purposes other than transit to work (such as shopping and recreational trips), and public service vehicles such as school buses, police and fire vehicles, and others. Public transportation in Erie and Niagara Counties, and to a lesser degree Genesee County, is of particular importance to densely populated areas where many people have no other means of transportation. Erie and Niagara Counties have a metropolitan bus service (NFTA Metro), while the city of Batavia has a city-wide service. All three areas also have a "Dial-A-Bus" system for the elderly. A public rapid transit and a more sophisticated bus system will be introduced to Buffalo in the near future. The system will be primarily designed to link the Buffalo central business district with Amherst.

2.54 The existing rail network in the flood plain is comprised of Penn Central, Lehigh Valley, and Erie-Lackawanna trackage. Rail service is predominantely east-west oriented with major north-south linkages located in the Buffalo (Baltimore and Ohio Railroad, Norfolk and Western Railroad, and Penn Central Railroad) and Batavia (Erie-Lackawanna Railroad and Baltimore and Ohio Railroad) areas.

2.55 Rail service in western New York, as well as the entire northeast, is being reorganized under the Regional Rail Reorganization Act of 1973 (RRRA). Under this Act, the United States Railway Association has recommended a rail network built around three major integral systems: Con Rail, with Penn Central as its core and including elements of smaller railroads in reorganization; an expanded Chessie System that would extend eastward into western New York; and the Norfolk and Western combined with smaller solvent carriers operating in their existing configurations with some new trackage rights and services. Most of the existing rail network in or immediately adjacent to the flood plain was recommended to be retained by the Con Rail or Chessie networks. 2/

2.56 In general, the Tonawanda Creek flood plain possesses adequate rail service, and the overall, long-term impact of regional rail reorganizations on western New York is not expected to be significant. There will be some dislocations and some firms may be forced out of business due to some abandonments. However, in the long run, the proposed organizational structure cannot only help the region's rail carriers function more efficiently and economically than they have in the past, but also serve industry by providing a more competitive mode of transportation.

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1/ See Appendix E, Table 2.T
2/ See Appenndix E, Plate 2.19

2.57 In addition to highway and rail networks, the Tonawanda Creek Watershed is served by water transit on the New York State Barge Canal, which was constructed partially on the site of the former Erie Canal. The existing canal system utilizes the Tonawanda Creek channel about its lower 12.5 miles. It has a navigable depth of 12 feet, a navigable width of 75 feet, and a total width of approximately 200 feet. During the canal navigation season (April to December), approximately 1,100 cubic feet per second are diverted from the Niagara River easterly, via Tonawanda Creek, to the Barge Canal, to supplement the normal east-west flow from Tonawanda Creek. This water is necessary for the operation of locks and maintenance of pool levels east of Lockport. During the closed season, a Barge Canal gate at Pendleton is closed to allow all flows to flow downstream toward the Niagara River. Commercial navigation has declined considerably on the canal. Today, the prime users of this facility are recreational boaters.

2.58 There are several private airports in the watershed which are used for recreational purposes. None of the facilities provide service to scheduled air carriers. Watershed airports include facilities in the towns of Amherst, Royalton, Newstead, and Batavia.

2.59 Five counties, 24 towns, four cities, two villages, and the Tonawanda Indian Reservation, are completely or partially located within the limits of the Tonawanda Creek Watershed. These minor civil divisions (MCD's) together with the State and Federal Governments, supply services to, maintain facilities for, and receive revenues from private and other public entities in the watershed.

2.60 Monies generated from various national and State income and corporate taxes on individuals and companies in the watershed are used to supply the region with numerous services and facilities. The Federal and State Departments of Transportation provide for the planning and construction of the watershed's primary highways. The U. S. Department of Agriculture and the New York State Department of Environmental Conservation offer agricultural improvement, land conservation, and other natural resource management programs and assistance to local municipalities and local landowners. Several wildlife and game management areas in the upstream area of the watershed are operated by State and Federal agencies. 1/ The Corps of Engineers completed a local flood control project at Batavia in 1956. Local Governments in the watershed's minor civil divisions provide many of the day-to-day public services and facilities. The scope of available services, which varies between each political entity, generally includes educational facilities and teaching services, local law enforcement and fire protection services, waste disposal facilities, libraries, hospitals and health care services and other public systems.

2.61 The value of real property taxes in 1970 for Erie, Niagara, Genesee, and Wyoming Counties was about $306.1 million. About 80 percent of the total value was generated from properties in Erie County. It is estimated that between $50 million and $100 million of the four county total was

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1/ See Appendix E, Table 2.CC

derived from properties in the Tonawanda Creek Watershed. Income taxes in 1970 on residents in the watershed's MCD's probably ranged between $50 million and $100 million for State income tax and between $200 and $300 million for Federal income tax.

2.62 Industry and Business - Industrial and business activities in the Tonawanda Creek Watershed are generally concentrated in the region's urban centers, particularly in the downstream cities of Tonawanda, North Tonawanda, and Lockport, and in Batavia in the upstream section of the watershed. The lower portion of the watershed, including the cities of Tonawanda and North Tonawanda, is located in an industrial-commercial corridor that parallels the Niagara River shoreline and stretches from the heavy industrial steel and automobile plants in Lackawanna (south of Buffalo) to the chemical and electrical power generating facilities at Niagara Falls. Industrial facilities of the Allied Chemical Corporation, the Dunlop Company, General Motors Corporation, the Occidental Petroleum Corporation, and other companies are situated within this corridor in the Tonawandas. Upstream from the Niagara River, manufacturing plants are more concentrated in the urban centers, such as Lockport and Batavia. The city of Batavia is the center of industrial activity in the upstream portion of the watershed. Over one-half of the total number of establishments, total employment, and total payroll of manufacturers in Genesee County was recorded in the city of Batavia in 1967. Business activity, including retail trade and service establishments, is more evenly distributed throughout the towns in the lower watershed. Numerous shopping malls and plazas, local business districts, and commercial strip developments are located in the lower region, particularly in the Tonawandas, Lockport, and the town of Amherst. In the upstream region, retail and service establishments are more centralized in the city of Batavia and, to a lesser degree, in the village of Attica.

2.63 Agricultural output of each county in the watershed is substantial. 1/ The most recent year for which agricultural data is available (1969) ranks Erie County as the number one producer within the watershed, in terms of value of agricultural output. Erie County's agricultural output exceeded $28.8 million in 1969; Wyoming County followed closely behind with $26.9 million. Principal crops within the watershed include dairy products, field crops, vegetables, fruits and nuts, and livestock other than poultry products. In the lower portion of the watershed, there is a stronger emphasis upon those agricultural commodities usually associated with truck-farm operations which serve urban centers. Genesee and Wyoming Counties are strongly oriented towards dairy farming and the production of those field crops required to support these animals.

2.64 Those farms in close proximity to the Buffalo SMSA are more than likely to be operated on a part-time or seasonal basis, whereas those farm units located further upstream are relied upon as the principal source of income by their owner-operator. A greater percentage of total farms in the upper reaches are commercial farms which produce at least $2,500 or more per

1/ See Appendix E, Table 2X

year of agricultural commodities, whereas Niagara County has the highest proportion of farms that produce less than $2,500 of output per year. The highest proportion of farms earning at least $2,500 per year are within Wyoming County.

2.65 Mining operations occur on a limited basis throughout the Tonawanda Creek Watershed. The National Gypsum Corporation, which is the only gypsum firm remaining in the area, has recently placed its mining operation in a reserve status due to poor regional market conditions for gypsum-related products. Hooker Chemical Corporation has several salt brine wells along Little Tonawanda Creek near Dale, NY. The salt obtained from this area is most likely used in the company's chemical plants in Niagara Falls. There are several stone quarries in the downstream portion of the watershed. The largest quarry operation in the watershed is Frontier Stone Products, which is located just south of Lockport. Quarry operators within the watershed produce stone blacktop and concrete aggregates, while a few quarries produce lime which is used in the steelmaking process. The largest production of natural gas in New York State now comes from Erie, Chautauqua, and Cattaraugus Counties. Small amounts of natural gas have been discovered in Wyoming County near Attica. All counties in the watershed, with the exception of Wyoming County, have sand and gravel operations. The majority of the sand and gravel is washed and screened for use in structural and paving concrete. Fill, industrial sand, and railroad ballast account for most of the remainder.

2.66 Employment and Income - Manufacturing industries provide the most jobs to watershed residents in all but two of the MCD's and account for at least 20 percent of employment in every MCD. Retail trade and professional fields of employment are generally the second and third most common types of employment in the downstream section of the watershed and in Genesee County. Agricultural employment ranks in the top three types of employment in Wyoming County in every town except Attica. The leading occupations of watershed residents are operatives and craftsmen-foremen who would be employed in semi-skilled or skilled jobs in industrial or commercial facilities. Clerical or service workers generally rank second in occupational employment in the watershed's urban and suburban areas, and third in the agricultural sections. Other major occupations include professional and technical workers, which are the leading occupations in the towns of Amherst and Clarence and the village of Attica, and managers and administrators. Farmers or farm managers are leading occupations in only three towns, all of which are located in Wyoming County. 1/

2.67 In 1970, both the household and family median annual incomes tended to be higher in the downstream, urbanized MCD's than in the upstream, agricultural areas. Household incomes ranged from a high of $12,709 in the town of Clarence to a low of $7,350 in the town of Java. Family incomes ranged from a high of $13,919 in the town of Amherst to a low of $8,563 in the town of Wethersfield. The percentage of families with annual incomes below $5,000

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1/ See Appendix E, Table 2.Z

ranged from 6.6 percent in the town of Clarence to 25.4 in the town of Java. The upstream MCD's in Genesee and Wyoming Counties tended to have a higher percentage of low-income families than the downstream areas. Significant economic changes have occurred in western New York since 1970 levels. At the end of 1975, over 12 percent of the Buffalo SMSA's labor force was unemployed.

2.68 Recreation - Detailed information describing recreation facilities within the watershed was based upon a facility survey conducted by the New York State Office of Parks and Recreation Comprehensive Outdoor Recreation Plan. A subsequent report utilizing the survey results was published in 1972 and listed detailed information concerning the size of activities available at each recreation site. 1/ Over 60 public and privately owned sites consisting of more than 21,500 acres were determined to lie within the limits of the Tonawanda Creek Watershed.

2.69 The largest concentration of recreational acreage is located in the central portion of the watershed near the Tonawanda Indian Reservation. This concentration is primarily attributed to the vast acreages associated with the Tonawanda Game Management Area (New York State) and the Iroquois Wildlife Refuge Federal). Together, these two wildlife areas account for 13,000 acres or 60 percent of the total recreational acreage available in the watershed.

2.70 A wide variety of activities are available at most of the watershed facilities. Most of the recreation areas upstream of the town of Clarence are privately owned and provide extensive facilities for camping and other activities most commonly engaged in by overnight and weekend campers (field sports, hiking and playgrounds).

2.71 Recreation facilities which are closer to high density population centers offer a slightly different mix of activities. Golf courses are common in the Buffalo Metropolitan Area, located approximately 30 miles west of Batavia. Ellicott Creek Park, a county-operated facility, is located about 3.2 miles upstream of the confluence of the creek and the Niagara River and about 32 miles west of Batavia. Several marinas are located along Tonawanda Creek near its confluence with the Niagara River. Recreational use of the lower section of the watershed tends heavily towards day use by residents in the adjacent suburbs and cities.

2.71a No parks, marinas, golf courses, or other developed recreational areas are located at the Batavia Reservoir Compound (Modified) site, although portions of the Batavia Cooperative Hunting area do lie within the site boundaries. Hunting, fishing, trapping, birdwatching, snowmobiling, and canoeing are believed to presently occur in areas of the Batavia Reservoir Compound (Modified) site. Portions of the Batavia Cooperative Hunting Area lie within the Erie Plain Floodland (100 year flood) of Tonawanda Creek. Floodlands associated with the entire watershed are identified on Plate 1.2 of this EIS.

1/ See Appendix E, Table 2.CC

2.72 Demography - Urban populations are heavily concentrated in the downstream portion of the watershed, particularly in northern Erie County. The city of Batavia and the village and town of Attica contain the only significant urban populations in the upstream portion of the watershed. Rural populations account for 100 percent of the total population in thirteen of the seventeen watershed MCD's in Genesee and Wyoming Counties. The distinction between downstream-urban and upstream-rural populations is further illustrated by the population densities in these areas. The population per square mile in four of the six watershed MCD's in Erie County

exceeds the average population density in the respective counties (1,052.5 in Erie County and 443.1 in Niagara County). With the exception of the city of Batavia and the village and town of Attica, population densities are generally less than 100 persons per square mile in the Genesee County MCD's and less than 50 persons per square mile in the Wyoming County MCD's. Median age tends to be somewhat higher in the Erie and Niagara Counties MCD's than in the upstream areas, while average household population tends to be slightly lower in the urbanized, downstream counties.

2.73 Data concerning the ethnic composition of the population indicates that the population is generally homogeneous throughout the watershed. A majority of the MCD's have less than a one percent nonwhite population. The only watershed MCD with significant nonwhite populations is the Tonawanda Indian Reservation, which is administered by the Seneca Indian Tribe and the town of Attica. Foreign stock populations (persons foreign born or of foreign or mixed parentage) account for less than 20 percent of the total populations in a majority of the MCD's, and tend to be concentrated in urbanized areas.

2.74 The level of community mobility (percent of households moving into residence 1969-1970) is generally less than the State level (15.4 percent) and the respective watershed county levels in each of the watershed MCD's. Relatively high mobility levels occurred in the town of Amherst (18.8 percent; suburb of Buffalo), the city of Lockport (17.6 percent), and the town of Cambria (20.0 percent; suburb of Lockport). Mobility was also high in the towns of Middlebury (21.7 percent), Orangeville (20.7 percent), and Wethersfield (17.5 percent). These towns border the town and village of Warsaw and have small, rural populations.

2.75 Cultural Resources - In order to assess the impact of the proposed project on significant or potentially significant cultural resources sites, the National Register of Historic Places dated 18 March 1980, and all subsequent revisions were consulted. Several sites were listed for the towns of Batavia and Alexander, however, they were outside the project boundaries.

2.76 The Public Archaeology Facility at SUNY-Binghamton conducted an archaeological reconnaissance, Phase I survey of that area of the Tonawanda Creek watershed that will be impacted by the construction of the Batavia Reservoir Compound (modified) under contract with the Army Corps of Engineers, Buffalo District. The area to be affected can be described, in general terms, as the flood plain of the Tonawanda Creek between Batavia and Alexander, Genesee County, NY. Methodology employed during the field investigation consisted of subsurface testing by means of shovel test pits, systematic surface survey of plowed fields, and walkover survey of grass-covered areas. During the survey, 23 new archaeological sites were recorded. Of these, one, SUBi 948, had a reported Paleo Indian component; 10 had a Middle to Late Archaic component (SUBi 947, SUBi 948, SUBi 949, SUBi 950, SUBi 951, SUBi 954, SUBi 958, SUBi 959, SUBi 960, and SUBi 999); one, SUBi 954, had a Transitional component, and two, SUBi 951 and SUBi 960, had a possible Early Woodland component. Seven prehistoric sites were unclassified (SUBi 952, SUBi 953, SUBi 955, SUBi 956, SUBi 957, SUBi 964 and SUBi 1000). SUBi 962 and SUBi 967 were historic foundations.

2.77 Nine prehistoric sites were recommended for intensive Phase II investigation. They are SUBi 947, SUBi 948, SUBi 949, SUBi 950, SUBi 951, SUBi 954, SUBi 959, SUBi 999, and SUBi 1000). Six prehistoric sites were recommended for less intensive Phase II investigation. They are SUBi 952, SUBi 953, SUBi 957, SUBi 958, SUBi 960, and SUBi 961. Two prehistoric sites, SUBi 955 and SUBi 9596, will require no further work. All six historic sites will require deed searches, precise measuring and mapping, and subsurface testing of the builders trench, if possible. Of the total project area, 39 percent was intensively surveyed by means of systematic surface survey or shovel testing, 31 percent was walked over, and 30 percent was not surveyed, as it was either open water or swampland.

2.78 The report entitled "The Batavia Reservoir Compound Phase I Archaeological Summary" which details the results of the Phase I survey has been coordinated with the New York State Historic Preservation Officer, the New York State Archaeologist, and the Interagency Archaeological Services - Atlanta, all of whom have concurred with the findings and recommendations of the report.

2.79 Aesthetics - The aesthetic characteristics of the creek are generally dominated by surrounding land uses and their particular aesthetic qualities. The creek itself is devoid of significant waterfalls and gorge areas. Land around the creek's headwaters in Wyoming County consists primarily of farm fields and various types of natural open-space (grass fields, brushland, wooded areas). The major man-made features visible in the upstream section are farm buildings, residences, roads, and rail lines. This type of visual setting is also evident in Genesee County outside of the developments at Attica, Alexander, and Batavia. At Attica and Alexander, only a few hundred feet of the creek pass through the community's small business districts. However, the creek meanders for about a mile through residential, commercial, and industrial areas of Batavia. Below Batavia, the general mix of agricultural and natural environments is again dominant, and views along the creek encompass adjacent fields, bankside trees and brush, and the creek's water surface. The level of man-made developments near the creek gradually increases downstream as the creek approaches the Niagara River. Recreational areas, such as Ellicott Creek Park in the town of Tonawanda, have preserved some of the creek's natural features in the downstream area.

2.80 Future Environments - In general, future land use patterns in the Tonawanda Creek Watershed are not expected to undergo significant changes through the early decades of the 21st century. The greatest potential future users of the Tonawanda Creek flood plain are farmers who plant a variety of grains and forage crops for consumption by the watershed's dairy operations. However, no net demand for agricultural land is expected since the general trend of decreasing farming units of larger size is anticipated to continue in the foreseeable future. Residential development is expected to move into the flood plain areas over time, particularly in the downstream areas in the vicinity of the Ransom Oaks development in the northern part of Amherst.

Commercial growth will probably be limited to small, concentrated plazas and local business districts developed in conjunction with downstream residential areas. Provision has been made for a planned industrial park in Amherst along Tonawanda Creek. Actual construction of this park would be primarily contingent upon the proposed Lockport Expressway, the development of which is uncertain at this time. No encroachment within the 100-year flood outline is expected to occur in either the city or town of Batavia due to large amounts of undeveloped land available in the northeastern portion of the city and large areas contiguous to the city limits in the town of Batavia. Residential development expected to occur outside the city will be tied into city water and waste treatment facilities. Local planning officials have indicated a desire to direct future industrial growth into the new industrial park located south of Pearl Street. Completion of an urban renewal project in the Batavia central business district should provide ample space for increased levels of commercial activity expected in the future. The potential recreation value of open-space corridors along Tonawanda Creek and its major tributaries has been recognized by the Erie-Niagara Counties Regional Planning Board, which has urged the incorporation of these riverine areas into the region's recreation plan. However, inland streams offer limited water recreational possibilities because of their small size and low sustained flows during the summer. The few inland lakes (Divers Lake and Phelps Pond in the town of Alabama) and scattered, small reservoirs offer limited water-oriented recreational possibilities because of their small size and inaccessibility for public use.

2.81 The northern part of Erie County in the Tonawanda Creek Watershed is expected to grow at a greater rate than the county as a whole, and about 30 percent of the county's total population is expected to be located in the watershed's MCD's by 2000. About half of Niagara County's residents will reside in watershed MCD's by 2000. Most of this growth will probably occur in Lockport and its suburban communities and in the development corridor between the town of Amherst in Erie County and Lockport. Both Genesee and Wyoming Counties are expected to experience about a 50 percent increase in population by the year 2000. In most cases, the rate of population increases in each county's MCD's in the watershed will be less than the individual county growth rates. The proportion of each county's population in watershed MCD's is expected to remain at about 65 percent in Genesee County and about 40 percent in Wyoming County. The total population of all MCD's in the Tonawanda Creek Watershed is expected to grow to about 576,000 by 2000, for a total increase of about 40 percent over the area's 1970 population.

2.82 Per capita income is expected to increase at about the same rate in both the upstream and downstream regions, with per capita income remaining slightly higher in the downstream area than in the upstream area. Total personal income is also expected to grow at about the same rate in both regions. Total employment is expected to increase in both regions throughout the next 50 years. However, in view of the recent decline in the local economy and the growing importance of the trade and commercial sectors, future levels of manufacturing employment in the downstream region (Erie and Niagara Counties) will probably remain constant. Manufacturing employment in the upstream region will probably continue to increase and account for about 30 percent of the area's jobs.

## 3. RELATIONSHIP OF THE PROPOSED ACTION TO LAND USE PLANS

3.01 General - The Buffalo District Corps of Engineers requested twenty-five public planning agencies that may have an interest in the Tonawanda Creek Watershed to evaluate the relationship of the considered flood control improvement alternatives to their respective land use plans for the project area. The planning agencies were requested to analyze potential areas of compatibility or conflict between the potential flood control alternatives and the objectives and specific terms of existing or proposed land use plans, policies, and controls, if any, that may have been formulated for the project area. Types of plans considered included master plans, zoning regulations, plans developed in response to Clean Air Act and Federal Water Pollution Act Amendments of 1972, and other related land use proposals. Letters of reply that were received in response to the above mentioned Corps request are included in Appendix B, "Letters of Coordination."

3.02 Agency Land Use Comments - The Attica Town Planning Board responded by letter dated 7 December 1975, indicating that the Sierks dam alternative does not comply with the master land use plan of the town of Attica on several points. It was also mentioned that the towns of Bennington and Sheldon are also involved and are interested in the Corps plans. The Board's chairman was contacted by a Corps planning representative on 12 December 1975 and was advised that the Sierks flood control alternative was not a viable project. It was decided that in view of this fact, a meeting between the township leaders of Attica, Sheldon and Bennington would then not be necessary.

3.03 The 8 December 1975 letter received from the New York State Department of Transportation indicated that the Corps letter of Coordination had been received and forwarded to the Director of the Department's Development Division. As requested in the letter, future correspondence will be directed to Mr. K. W. Shiatte, Director of the Development Division, Albany, New York, with a carbon copy of any notification letters to Mr. J. K. Mladinov, Assistant Commissioner for Planning and Development.

3.04 In a letter dated 16 December 1975 from the Genesee County Department of Planning, the Department responded as follows:

3.05 The Sierks and Linden Reservoir alternatives do not directly affect land in Genesee County. However, the Linden Reservoir alternative is important to the County because of its potential use as a source of water, which could be used in developing a county-wide water supply system. The Genesee County Department of Planning also indicated that, the Linden Reservoir alternative would provide necessary control of the level of Tonawanda Creek that would help reduce spring flooding on lands in the towns of Bethany and Alexander. The Board also indicated that the Alabama Pools flood control alternative on the Tonawanda Game Management Area, does not conflict in any way with land use planning as seen by the county planning department. With regard to the Batavia Reservoir Compound, the planning department felt that it would affect a rather substantial amount of land in the town of Bethany,

and that present land use plans call for continuation of these lands as agricultural. They indicated that implementation of the Batavia Reservoir Compound measure would reduce the annual flooding of the more extensive lands in the towns of Bethany and Alexander, and that the county planning board would be supportive of such an approach. From a cost benefit analysis the Board felt that the Batavia Reservoir Compound should be given priority by the Corps. They also advised that the Modification to Existing Corps Project at Batavia would seem to fit nicely with the Batavia Reservoir Compound, for an overall program of flood control and recreational development, for the area along the Tonawanda in the city and town of Batavia. As further information on flood management in the Tonawanda Creek Watershed becomes available, the Corps will continue to coordinate its efforts with the Genesee County Department of Planning as requested.

3.06 The County of Erie Division of Planning reviewed the various flood control alternatives and indicated in their letter that, "the project should have no significant control on Erie County," and that "none of the alternates appear to have any detrimental effects upon land use development in this area, and the reduction of possible flood damage and the improvement of water quality will be beneficial."

3.07 The Erie and Niagara Counties Regional Planning Board responded in a letter dated 18 December 1975, and inclosed a copy of the statement submitted by the Utilities Committee of the Regional Planning Board and given at the 20 November 1975 public meeting in Batavia, New York. A copy of the Utilities Committee statement inclosed with the 18 December letter is included in Appendix B of this environmental statement.

3.08 The Orleans County Planning Board's letter received by the Corps on 19 December 1975 mentioned that, the proposed flood management program has a relatively minor impact on Orleans County - the only area being in the southwest corner of the county where Niagara and Genesee Counties abut Orleans. As stated in the letter, "most of the land in question is part of the Oak Orchard Swamp and is under Federal management. The County Planning Board's Preliminary Land Use Plan calls for continued protection of these lands as a natural wildlife refuge. Other areas, adjacent to Oak Orchard Swamp are designated as resource management areas." The Board's letter also mentioned the Shelby Township ordinance which "designates other adjacent areas as agricultural use districts." The residential use district is also defined in the ordinance, and is given in the Board's letter which is included in Appendix B. As stated, "in effect this ordinance allows for and encourages the strip development of all roadways in the town of Shelby. The County Planning Board opposes strip development of any nature. However, it is a fact of which you should be cognizant as it appears there are local roadways which are located in that area of Orleans County which was defined in Plate 1 of your interim report." The Corps re-reviewed the location of the Alabama Pools alternative and found that this considered measure would lie totally within Erie-Niagara Counties, south of Route 77. No roads within the town of Shelby in Orleans County would be affected by the project. Therefore, t' ' alternative plan would not interfere with possible strip development along any road within the town.

3.09 New York State Department of Environmental Conservation, in letters dated 20 February 1980 and 29 September 1980, had the following comments:

3.10 The Division of Fish and Wildlife concurred with the findings and recommendations of the report prepared under the authority of the Fish and Wildlife Coordination Act (16 USC 661) for the proposed flood control project along Tonawanda Creek in the towns of Batavia and Alexander, Genesee County, NY. They also made several specific recommendations for sites to be considered as mitigation.

3.11 The Division of Fish and Wildlife felt that instead of using the term "selective snagging," the report should indicate that stumps embedded in the bank should be cut rather than pulled, and where they would not materially affect the roughness of the bottom, deeply embedded logs were to remain in the bottom. They also believed that instead of building a stairway or path traversing the dams, the Batavia-Alexander Recreational Trail should be rerouted around the structures.

3.12 The Town of Batavia Planning Board responded to the Corps request in their letter dated 10 January 1975, by providing the Corps with copies of their master plan and existing zoning ordinances, together with amendments for review.

3.13 The following land use planning agencies were contacted but did not reply to the Corps request: U. S. Department of Housing and Urban Development; Bureau of Outdoor Recreation; NYS Office of Parks and Recreation; NYS Department of Commerce; NYS Urban Development Corporation; Wyoming County Planning Board; Middlbury Town Planning Board; Attica Village Planning Board; Attica Town Zoning Board; Batavia City Planning Board; Batavia Town Zoning Board; Darien Town Planning Board; Darien Town Zoning Board; Pembroke Town Planning Board; Pembroke Town Zoning Board; Stafford Town Planning Board; and Stafford Town Zoning Board.

## 4. PROBABLE IMPACT OF THE PROPOSED ACTION ON THE ENVIRONMENT

4.01 The Batavia Reservoir Compound provides flood protection in two major floodlands of the Watershed. It provides roughly 10-year protection between its upper and lower dams, and provides roughly Standard Project Flood protection in that part of the Erie Plain floodland downstream from the lower dam. The Compound provides about 50-year protection in the Huron Plain floodland.

4.02 Persons residing within the limits of the maximum probable flood pools of the Batavia Reservoir Compound would be relocated outside these designated limits. About nine residences in the upper reservoir and 37 residences, five farmsteads, and one business in the lower reservoir would need to be relocated. Relocation is acceptable to those persons whose properties are frequently flooded under existing conditions, but less acceptable to those whose properties are not frequently flooded. Flowage easements would be purchased on a total of 4,765 acres of land in the upstream and downstream reservoir areas and immediately downstream of the lower embankment. Lands would be purchased outright for construction of both embankments and outlet works. The amount of land to be purchased and become property of the Federal Government is 95 acres. Farms could be worked in the flowage easement areas during nonflood periods. With this project, the flood area between the two dams would be susceptible to flooding less frequently than under existing conditions. Social impacts associated with relocation would include some inconvenience to floodplain residents that have to move their personal possessions to new homes. Movement could either be to nearby areas just outside the Batavia Compound project zone, or to more distant areas that would necessitate readjustment to new neighborhood conditions and to new transportation routes to work. Regional losses could include minor reductions in the tax base, employment and income, if persons were to relocate outside the region. Movement to locations outside the floodplain would mean that such residents would no longer have to experience a flood threat to life, property and personal possessions.

4.03 Disturbance of the environment by construction activity in the project locale would cause temporary unsightliness in the existing rural setting. Some unavoidable soil compaction from use of construction equipment could be expected; such compaction could inhibit or delay establishment of vegetation to some degree that would be used as wildlife habitat and soil cover. Some temporary erosion, stream turbidity and sedimentation is unavoidable during construction and maintenance periods. Suspended materials such as mud, silt, microscopic animals and plants would temporarily contribute to water turbidity. Turbidity would temporarily reduce sunlight penetration, thereby affecting aquatic plant photosynthesis, food chains, and disturb ard temporarily drive some fish out of turbid water areas. Silt deposition would unavoidably smother some benthic organisms along the streambed. Use of heavy equipment for clearing debris jams and snags, excavation, filling, grading and hauling of materials would cause temporary noise, mud and dust in the general vicinity of the project site; this would include work activities on access roads and rights-of-way. Lands cleared during construction by grubbing and clearing would eliminate existing woody and herbaceous vegetation, disturb surface soils, alter the existing rural

setting and destroy some wildlife habitat. The spillway, dams, and dikes constructed on grubbed and cleared lands would be reseeded with an appropriate seed mixture adaptable to the soils and climate in the project locale, to help mitigate impact on the rural aesthetic appearance, provide herbaceous vegetation for wildlife and to help provide plant cover on exposed disturbed soils due to construction as soon as possible for soil conservation purposes. Materials obtained from grubbing and clearing would be buried at the disposal areas described in paragraphs 1.08 and 1.14. Hauling the material to the disposal areas would require use of public roads by hauling trucks traveling to and from the project locale. Such hauling trucks would unavoidably cause some dust and noise during the travel periods, as well as track mud from the project area onto public roadways. Army Corps of Engineers specification CW 01430, dated June 1978 "Civil Works Construction Guide Specifications for Environmental Protection" requires that all emitted water, atmospheric and noise pollutants are to be in compliance with Federal, State, and local standards. The Contractor would be required to abide by the general requirements outlined in the aforementioned specification.

4.04 Construction activities could temporarily disrupt vehicular traffic flows and patterns in the proposed compound vicinity. Such disruptions would be localized and of low-magnitude due to the distance of the construction areas from major urban zones. Short-term detours might be required to avoid potential interference and safety hazards that would result from the presence of automotive traffic in close proximity to construction equipment.

4.05 Possible interruption of local travel routes during construction might temporarily affect some business activity at commercial facilities in Batavia and Alexander. However, some local businesses may benefit by the presence of construction personnel and equipment through purchases of routine goods and services, such as meals at local restaurants, petroleum products from service stations, and others. Minor amounts of public revenues would be derived from such purchases.

4.06 Temporary adverse aesthetic impacts would result during the presence and operation of construction equipment in the project area. Construction equipment and work areas will be visible by a limited number of residents and commuters using roads near the project area. Project activities would not be expected to increase noise levels significantly, except in immediate work areas. This effect will be temporary and will affect only those people present in the immediate area, such as residents of dwelling units peripheral to the project area. The New York State Department of Environmental Conservation, Bureau of Noise would be consulted for assistance in developing noise control measures applicable to the proposed project. If during the course of construction activities, it were determined that construction related odors from equipment were affecting residents in the vicinity of the project, appropriate measures would be implemented to modify or eliminate such effects.

4.07 During construction, there would be a need for temporary use of local utilities such as water and electricity, due to the need for such resources by construction equipment and personnel.

4.08 Construction activities and use of heavy equipment would create a temporary potential safety hazard to those who may be present at the work site. However, general safety requirements as outlined in various Corps of Engineer safety manuals would be used as guidelines to implement necessary safety procedures. These manuals include safety requirements with regard to accident reporting, sanitation, medical facilities, personal protective apparel, clothing and safety equipment, welding and cutting, electrical wiring and apparatus, hand tools and power tools, machinery, mechanized equipment excavations, stipulations on accident prevention on contract work, and control of occupational health hazards.

4.09 Assuming that construction materials and equipment would be purchased from suppliers in the Tonawanda Creek region, local and regional economic factors would benefit from the introduction of construction monies into the economy. Employment would also benefit due to the need for construction personnel during project implementation. The exact nature of any long-term affects of such short-term economic stimulation are difficult to predict. However, in view of the current adverse national economic conditions, particularly in the construction trades, construction-related spending could enhance long-term business activity and employment, and increase tax revenues derived from these sources.

4.10 The proposed project and resultant reductions in flooding would generally result in long-term, beneficial effects on existing conditions of the human environment of the Tonawanda Creek Watershed. The frequency and magnitude of disruptions to local transportation systems would decrease, thereby reducing losses of time and money caused by flood-related detours. The value of existing residential and business developments in protected areas would be enhanced. Public revenues derived from such developments could increase in relation to property values, production and sales values, and other sources of public monies. The population's sense of safety and security would also be enhanced by the knowledge that flood protection is available.

4.11 Flood protection could result in increased development in presently unoccupied areas, and the expansion of existing developments in the protected floodplain areas between Batavia and the Niagara River. The nature of future residential, commercial, industrial, transportation, or other developments and expansions will be regulated by local land use plans and zoning laws, investment opportunities, population changes, and other factors. Should such developments occur within the limitations of these constraints, the following impacts on the human environment could be expected.

a. Land use changes would occur if existing undeveloped areas (natural open space, inactive agricultural lands, etc.) were converted to residential or other types of developed areas. Such changes would probably occur in close proximity to existing intensive developments, such as those in Batavia and Amherst.

b. Additional transportation facilities would be needed in order to accommodate the movement of people and goods to and from new developments.

c. Utility systems, including gas, electric, telephone, and water supplies and facilities, would require expansion into new developments.

d. Public services and facilities, including law enforcement, fire protection, education, and health services, would also require expansion.

e. Public revenues would increase due to increases in property taxes, sales taxes, and other sources. Demands upon public revenues would also increase due to the need for additional public services and facilities to meet the requirements of growing residential and business populations.

f. Total employment and income levels would increase if commercial and industrial development were to occur. Residential growth would probably be accompanied by retail stores and service establishments to meet the needs of daily living.

g. The demand for public and private recreational facilities would increase in relation to growth in the residential population. Immediate needs would probably favor the development of parks, playgrounds, and other recreational facilities that would be used on a frequent basis.

h. While the area's total resident population would probably increase, its demographic characteristics (ethnicity, age, sex, etc.) would probably reflect those of surrounding established communities. Community mobility would increase as new residential and employment opportunities were created. With such growth, community cohesion in rural towns and villages of the flood plain could gradually be changed to various degrees, as new residents moved into their communities, as new business opportunities developed, and as more services were provided on lands given flood protection by the Batavia Reservoir Project.

i. Some cultural resources could be lost, although the opportunity to preserve and enhance significant archaeological and historic sites would undoubtedly be considered in the development of public recreational areas.

4.12 The Tonawanda Creek Canoe trail shown in the Genesee County Department of Planning "Open Space Recreation Plan" [28], includes part of the creek within the Batavia Reservoir Compound. Removal of fallen trees in the creek as part of the flood management plan, would also help to keep the canoe trail open for such recration use. At present, frequent flooding in the compound site creates hazardous conditions for canoeing. If the reservoirs in the compound were constructed, pools created by storage of water would temporarily make canoeing hazardous, or probably prevent canoeing recreation during significant floods, until stream conditions returned to normal. Under normal stream conditions, gates would be open. Refer to paragraph 4.22 for project impacts on recreation hunting, fishing and general recreation.

4.13 The plan would reduce existing average annual flood damages in the Tonawanda Creek watershed by approximately 74 percent. Residual average annual damages would be moderately low.

4.14 The economic efficiency of the plan, based on an economic life of 100 years and an interest rate of 7-5/8 percent, is 1.32. The average annual net benefits of the plan are $800,500.

4.15 The project would intercept runoff from the Tonawanda Creek Watershed upstream from the city of Batavia - a tract about 172 square miles in area. This tract represents approximately 33.7 percent of the whole Watershed.

4.16 If the Batavia Reservoir Compound were constructed, farmland use within this site would remain essentially the same except in the upper reservoir where farmland use would be significantly reduced. Under existing conditions, the compound site floods naturally. The upper reservoir would provide about 10-year flood protection to land near the upper dam located within the lower reservoir. Flooding up to about 500-year magnitude would be temporarily detained at the site of the compound 2 to 8 days longer than under natural conditions. Floods greater than about 500-year recurrence frequency would pass significant amounts of water over the emergency spillway. Land in the compound could still be farmed whenever the project site is not subject to flooding. Removal of snag and debris accumulations from the creek between the upper and lower reservoirs would reduce flooding on some farmland in the compound.

4.17 When flooding occurs under existing conditions, parts of roadways are frequently inundated, eroded, and clogged with debris and gravel deposits that render them temporarily unusable. Downstream of the proposed Batavia Reservoir Compound site, significant flooding causes similar problems on other roadways in the Erie Flood Plain. The proposed project would provide about a 10-year degree protection for roadways and the railroad in the lower reservoir site of the compound, roughly Standard Project Flood protection to transportation routes in the Erie Plain floodland downstream from the lower dam, and roughly 50-year degree protection to transportation routes in the Huron Plain floodlands. After project construction, the upper compound area would tend to collect some debris, silt, and gravel during flooding periods; when the temporary flood pool subsides, such material accumulations could be unsightly. Also, after construction, the existing flood plain would contain man-made features such as dams, water control structures, and an emergency spillway. A beneficial aesthetic impact that could be expected after construction, is the anticipated reduction in deposition of debris, silt, and gravel downstream of the upper dam. During construction, the dams, dikes, and emergency spillway would present an adverse aesthetic appearance on the landscape, until these areas were seeded and well estabished to herbaceous vegetation cover.

4.18 Flood protection provided by the proposed project would eliminate or reduce frequency of flood related damage to roadways. In turn, this would help to reduce maintenance costs. Since roadways normally subject to frequent flooding would be less susceptaible to flooding, access onto roadways by public service traffic and private vehicular traffic would be somewhat improved.

4.19 The proposed flood protection project would help to reduce significantly the frequency of clean-up and damage repair work in the flood plain by property owners and public service employees. Expenditure of labor, time and money to repair damages to personal property, public property and utilities would be reduced. The project would protect life, health, and property of flood plain residents.

4.20 Approximately 1,000 acres of wetland now subject to flooding under existing conditions, are interspersed within the maximum probable floodpool limits of the Batavia Reservoir Compound. These wetlands would still be subject to some natural flooding, however, wetlands in the lower reservoir would be subject to less frequent natural flooding, because some degree of flood protection to all flood lands within the lower reservoir would be provided by the upper reservoir. In general, soils on existing wetland areas within the compound have poor drainage. These wetlands are found on such soil types as poorly drained Madalin silty clay loam, very poorly drained Fonda Muckey silt loam, very poorly drained Lamson Muckey very fine sandy loam, and somewhat poorly drained Rhinebeck silt loam. Wetland herbaceous vegetation such as sedges, rushes, cattails, and iris and some woody shrub species, have established within or around the periphery of these areas that help to provide winter cover and nesting habitat for wildlife. It is anticipated that such vegetation would still be present on wetlands within the compound after the project was constructed. Some of these wetlands hold shallow water year-round and many are intermittently wet. As indicated on the Batavia South, NY, USGS Quadrangle (1950), many of the wetlands shown are fed by small tributary brooks that flow into the flood plain from outside the project locale. 1/ Soils in these wetlands are generally poorly drained. Some of the wetlands observed were completely covered over with herbaceous aquatic plants; in some cases, these wet areas were dominated by very dense growths of iris. It is anticipated that water entering these wet pockets would be held longer by poor soil drainage and decreased rapidity of evaporation from soil at the base of plants due to the density of vegetation.

4.21 Construction of the dams and dikes for the Batavia Reservoir Compound would require filling in approximately 44 acres of wetland (out of approximately 1,000 acres) in the existing Batavia Reservoir Compound Area. Filling in of wetland acreage in dike and dam construction locations would mean unavoidable loss of existing winter cover and nesting habitat for wildlife on such areas. These lands are predominantly intermittently wet on a seasonal basis, and generally contain dense vegetation growths of

1/ Refer to Appendix G

cattails, sedges, rushes, iris, and scattered shrubs and trees. During the late October 1975 field trip, many of the wetland soils in the compound were moist at the surface with little or no standing water. The wetland area southeast of the Delaware-Lackawanna Railroad and Erie Railroad tracks is wet year-round, with relatively deep standing water over most of its area.

4.22 Lands along the alignment of embankments and dikes would be purchased by the Government. Other lands of the Batavia Reservoir Compound would be under easement as required by the function of the project, but would be retained in private ownership. Properties located within the Batavia Cooperative Hunting Area of the compound site would still be used for recreation hunting as desired. Such hunting lands within the Erie Plain are frequently flooded under existing conditions. However, within the Batavia Reservoir Compound, inundation of the cooperative hunting area would still occur, but these lands would flood less frequently. Factors contributing to flooding in the compound site are shoals and debris accumulations which impede flow within some parts of the channel. From a flood management standpoint, removal of such obstacles to flow, would allow water to pass through the existing channel better, thereby reducing the potential for some frequent overbank flooding onto adjacent terrestrial hunting lands. Also, flood protection provided to hunting lands in the lower reservoir by the upper reservoir, would make these lands more available to access. Although some flood protection would be afforded to cooperative hunting lands in the upper reservoir, if significant flooding were to occur during the hunting season, water would be temporarily stored over a larger area here, and in general, to greater average depths. During such periods, land within the upper reservoir would be temporarily inaccessible to sportsmen hunting terrestrial wildlife. With regard to recreation fishing and general recreation (i.e. - bird watching, hiking) it is anticipated that these types of outdoor recreation activity could be pursued by the public in much the same manner after the proposed project as under existing conditions. However, in the event of significant flooding, impounded water would temporarily render the compound area inaccessible for such recreation until water subsides and adjacent lands drain water off into the creek.

4.23 Wildlife habitat would be given some degree of protection from frequent flooding in the compound, as well as on lands downstream. The degree of protection from flooding downstream would vary depending on distance from the Batavia Reservoir Compound and other factors. Damaging floodwater velocities that scour and erode soil, destroy and dislodge vegetation, and deposit silt, sediment, and debris over the land, would be reduced in the flood plain. Although floodwater velocities would be reduced, detention of water in the compound during floods of roughly Standard Project Flood magnitude, would result in a slightly broader area of wildlife habitat being temporarily inundated, than under existing conditions. If flooding at this degree were to occur during the winter, existing vegetation that provides winter cover habitat to wildlife in the compound would be temporarily unusable to terrestrial wildlife, or could be destroyed to some degree. If it were to occur during the spring or summer months, nests of terrestrial wildlife and waterfowl would be inundated and destroyed over the temporary floodpool area. Under present conditions, vegetation in the proposed project area frequently experiences temporary seasonal flooding. During summer field

inspection, it was observed that silt and gravel deposition associated with overbank flooding, has covered over some agricultural lands in the flood plain and peripheral natural vegetation, which has inhibited or destroyed growth and establishment of some grain crops, grasses, legumes, and wild plants.

4.24 Construction of embankments and dikes of the proposed project would require clearing and stripping about 126 acres. Removal of trees, shrubs, and herbaceous vegetation in this area would eliminate some existing food and cover habitat used by wildlife. After construction of the embankments, dikes, and spillways, topsoil would be replaced on disturbed areas, access roads would be constructed, a seedbed would be prepared, and the disturbed area would be seeded and mulched.

4.25 Removal of debris jams and snags from Tonawanda Creek within the Batavia Reservoir Compound, would cause some temporary stream siltation and destroy some habitat for aquatic organisms. In areas of debris and snag removal, stream sediments would be unavoidably disturbed, and redeposition of silt would occur downstream, which would cover over some benthic macroinvertebrates. Since it is probable that existing debris and snags may provide spawning and cover areas for fish, removal of such snags and debris to help achieve flood management, would destroy such fish habitat. The extent of debris and snag removal has not yet determined during this phase of the engineering study; however, if detailed design work is authorized by Congress, the extent of debris and snag removal would be more specifically determined.

4.26 In addition to the initial expenditure of time, labor, fuel, and funds needed to construct the proposed project, some annual expenditure of these resources would be necessary to maintain this proposed flood management plan.

4.27 If the project were implemented, flood damage protection would be provided to known and unknown cultural resources in downstream floodlands of the Tonawanda Creek Watershed. However, it is also possible that the flood protection provided to downstream floodlands could be followed by some increased development, which in turn may have an impact on any unknown cultural resources.

4.28 A short section of Peaviner Road (a County road), including a bridge on the road, would be relocated (realigned) at Federal cost. Also, a short section of Creek Road will be realigned.

4.29 Four known prehistoric sites are located within the Batavia Reservoir Compound, plus approximate locations of four additional sites. If the Selected Plan is authorized and funded for further study, an intensive survey of direct impact areas, as well as an assessment and probable survey of selected indirect impact areas would be accomplished, as recommended in the cultural resources report (Appendix F).

4.30 After flood pools recede within the Batavia Reservoir Compound, it is possible that some fish could be trapped in low terrain pockets within either pool area of the proposed project. Since the upper flood pool of the

proposed project would provide some degree of flood protection to lands downstream of the upper dam, flooding below the upper dam would be less frequent and potential for fish entrapment below it associated with overbank flooding would then be less frequent. Also, because the Batavia Reservoir Compound would significantly decrease the frequency of flooding below the lower dam, overbank flooding on downstream terrain would be less frequent and potential for fish entrapment would likewise decrease.

4.31 It is anticipated that the proposed project will not have a significant impact on any threatened or endangered species of fish and wildlife. Habitat such as cavernous limestone areas for the Indiana Bat are lacking in the project area, and the Eastern Timber Wolf has been extirpated from this locale. Based on river and lake habitat requirements for the Shortnose Sturgeon and Blue Pike, these species would not be expected to occur in the Tonawanda Creek project area. Because the range of the bog turtle is more to the east of the project area, presence of this reptile in the Batavia Compound would be unlikely. Communication with the Region 8 NYS Department of Environmental Conservation Biologist in December, 1975 revealed that Osprey, bald eagles and golden eagles have been seen on a regular basis in areas around the Iroquois National Wildlife Refuge and the Tonawanda Wildlife Management Area. The NYS biologist also noted that an American Peregrine Falcon was also seen on the Tonawanda Wildlife Management Area; it was further indicated that although no known nesting sites of any of the above mentioned species can be identified as being within the Tonawanda Creek Basin, suitable habitat does exist in the basin to support a small breeding population of one or more of these species.

4.32 <u>Mitigation</u> - to help mitigate environmental impact on soil and vegetation in the proposed project area, disturbed lands would be planted with a herbaceous seed mixture, and/or trees and shrubs adaptable to growing conditions in the area, as needed, to help minimize soil loss on disturbed lands. Terrain from which terrestrial vegetation is removed during construction, would be promptly fertilized, planted, and mulched where needed, to help mitigate the aesthetic impact and to protect exposed soil from erosion. During construction, the Contractor will be required to minimize temporary environmental impacts such as noise, dust, and water turbidity, in accordance with the procedures and regulations outlined in the Civil Works Construction Guide Specification for Environmental Protection (CW-01430, 1978). In order to insure that these procedures and regulations are properly implemented during and after construction has been completed, annual inspections will be conducted by the Corps to check on the operation and maintenance of the project. The Contractor would be required to have water-tight equipment, including coamings, which must be maintained in order to prevent spillage of oils and excavated materials. In addition, the Contractor would be required to prevent or control siltation, air pollution, erosion, spillage (including accidental), disposal, turbidity and maintenance of any pollution control facilities deemed necessary for the duration of the project. Consideration would also be given to installation of temporary sediment basins and shallow interceptor ditches to contain runoff from soils disturbed by construction, where needed.

## 5. PROBABLE ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

5.01 Regardless of the degree of caution and restraint used by the Contractor, construction of the project would cause some unavoidable adverse impacts that include:

(a) Temporary erosion, where soils are disturbed by heavy equipment and temporary mud, dust, and noise during initial construction and during future maintenance periods.

(b) Some unavoidable soil compaction from use of heavy equipment.

(c) Some temporary aesthetic impact in the project site caused by construction activity that includes stripping, clearing, and grubbing, as well as hauling of materials to and from the site.

(d) Possible short-term detours on some roadways within the project locale.

(e) Permanent removal of existing vegetation in the vicinity of construction. This would include clearing and stripping about 126 acres. These areas would be used for construction of dikes and spillway associated with the Selected Plan.

(f) During construction, temporary stream turbidity would be expected from use of heavy equipment, grubbing, clearing, and snagging, and dam and dike work. Construction activity would cause some suspended materials such as mud, silt, microscopic animals, and plants to contribute to water turbidity. This would temporarily reduce sunlight penetration into creek water that could have some affect on aquatic plant photosynthesis and food chains. Silt and sediment deposition would smother some benthic organisms along the streambed.

5.02 Removal of debris jams and brush snags from the Tonawanda Creek channel to improve channel capacity to conduct stream flow, could unavoidably destroy cover areas provided by such jams and snags that possibly are used by fish as spawning and nursery areas. Also, creek sediments would be disturbed to some degree, that would cause some unavoidable stream siltation and disturbance of benthic habitat.

5.03 Construction of the embankments would unavoidably fill-in about 44 acres of wetland out of an existing approximate 1,000 acres in the compound area.

5.04 If the project were constructed, during floods of roughly Standard Project Flood magnitude, the terrestrial land area that would be temporarily flooded in the lower reservoir would be the same as under existing conditions. However, in the smaller upper reservoir, the terrestrial land area that would be temporarily flooded during a Standard Project Flood would be a slightly greater area, at a somewhat greater average depth, than under existing conditions.

5.05 If the proposed project is implemented, relocation of 46 families, six farms, and one business would be a significant unavoidable adverse impact associated with the project.

5.06 Expenditure of time, labor, fuel, materials and funds to construct and maintain the project would be necessary and unavoidable.

## 6. ALTERNATIVES TO THE PROPOSED ACTION

6.01 In addition to the selected plan of action described in Chapter 1 of this Final Environmental Impact Statement, other plans were considered in developing basic alternatives for flood damage management in the Tonawanda Creek Watershed. These basic alternative plans are identified and discussed below, and their general locations are shown on Plate 6.1.

### ALTERNATIVE PLAN: NO ACTION

6.02 Description - No Action means the Corps of Engineers would do nothing to alleviate flooding in the Tonawanda Creek Watershed.

6.03 Socio-Economic and Environmental Impacts - If nothing was done to reduce the flooding problems in the watershed, there would be no expenditure of Federal money for flood management in this area. Inundation of the flood plain would continue to occur, and residents would still experience property damage and personal hardship. Continued flooding would jeopardize the health and safety of flood plain residents. Floodwaters would deposit debris on properties and temporarily cut off transportation routes for movement of emergency vehicles. Lack of adequate flood protection would continue to create a feeling of community insecurity among flood plain residents. Since the threat of significant flooding would continue to be a possibility, sale of homes in the flood plain may be more difficult. In addition, maintenance to correct flood damages would require expenditures of time and money by landowners and public service agencies, to help restore any damaged property, roadways, drainage ditches, culverts, and utilities. Temporary impacts such as relocation of affected families, disruption of transportation routes, utilities, employment, commercial and farming activities would continue.

6.04 Any archaeological sites located along the banks of Tonawanda Creek could be disrupted by floodwater scouring action caused by creek flows of increased velocity, thereby precluding salvage or protection of any such cultural resources in the future.

6.05 Since no measures would be implemented for flood control, the existing terrestrial and aquatic environment would not be disrupted by construction. However, environmental changes would continue to occur due to natural erosive forces and present land use by man. Homes and properties as well as fish and wildlife habitat would continue to be susceptible to flood damage.

6.06 This alternative plan was not selected because it does not provide for flood management in the Tonawanda Creek Watershed, and because residents within the flood plain would continue to experience property damage, personal hardship and threat to human health and life.

ALTERNATIVE PLAN: NON-STRUCTURAL BASE PLAN

6.07 Description - The nonstructural base plan provides for a combination of measures that includes flood warning and emergency action, floodproofing, flood insurance, flood plain regulations, and permanent evacuation. The total number of units affected in some way by a flood of 100-year magnitude, in the Tonawanda Creek Watershed would be about 4,921. Of these units, approximately 140 would be relocated and 4,508 units would be floodproofed. Remaining units would not require structural alteration due to the structural characteristics of these units (i.e. houses on knolls). Flood warning procedures would be developed to provide floodplain residents with hydrologic information regarding expected timing and severity of flooding. Flood insurance and flood plain regulations would be established in accordance with the National Flood Insurance Program. Under the Flood Insurance Program, administered by the Federal Insurance Administration of the U. S. Department of Housing and Urban Development (HUD), owners of all types of structures may purchase insurance to compensate for losses caused by flooding. In return for the Federal subsidiary, local Governments in New York State are required to adopt certain minimum land-use measures to reduce or avoid future flood damage within floodprone areas. Flood plain regulations (such as designated floodways and encroachment lines, zoning, subdivision regulations and building codes) are legal tools to control extent and type of future development permitted in flood prone areas. In New York State, the development and implementation of flood plain regulations are the responsibilities of local Governments. The general theme of such regulations is to keep highly flood damageable property and real estate out of the flood hazard areas. This alternative plan would be implemented by local communities. Each community would need to establish plans for: (a) flood warning and emergency action to alert local people, (b) coordination and assurance that all homes in flood prone areas are adequately floodproofed to at least the 100-year flood level or 3 feet above the first floor, (c) development of flood plain regulations to limit the amount and type of development in the flood prone areas, in order to qualify under the National Flood Insurance Program, (d) and establishment of a plan to permanently evacuate residents from the flood hazard areas.

6.08 Socio-Economic and Environmental Impacts - An adequate flood warning system would provide timely information to flood plain residents in the lower watershed. Movement of floodwater from the upper watershed is slow enough to allow for time to warn residents in downstream areas. Implementation of a flood warning and emergency action system would not preclude flood-related property damage with resultant hardships to residents. A flood warning system requires installation of early warning equipment to monitor stream flow. Local funds would be used to install, maintain and operate such equipment. This plan is not very reliable, because there is the possibility that the warning system could break down, thereby precluding prompt dissemination of flood warning information to area residents. Also, funding to operate the system may not always be available to local interests. People have to be available to carry out emergency actions. Property loss would still occur when people are away from their homes, or do not have the means to carry out the emergency actions within the limited time provided by warnings. This plan provides varying degrees of protection to floodlands of

the watershed. There would be about 24 to 36 hours to implement early warning and emergency action to protect life and property effectively in the city of Batavia. Adequate facilities for feeding, housing, and health care of flood victims would have to be made available. An emergency plan would have to be developed, practiced and implemented when required.

6.09 The benefit of floodproofing depends upon the abilities and inclinations of people to place floodproofing closures in time. Such closures could be temporary or permanent. Flood damage could be reduced by this measure, however, appearances of properties and structures would be affected to some degree by floodproofing. Effectiveness of floodproofing depends largely on such factors as depths and durations of flooding around floodproofed structures and on velocities and debris loads of flood flows. Flooding of significant depth and duration could affect the social well-being of residents on floodproofed properties by stranding persons in flooded areas, thereby possibly creating significant problems with regard to food, heat, and personal health. It is possible for a greater flood to occur than the degree of floodproofing protection, thereby creating risk of serious danger to persons stranded in their homes. Flooded roads make access difficult for fire and emergency equipment and public utility services. It is possible for floodwaters of significant depth and duration to cause the walls of floodproofed structures to fail. High velocity currents could erode or overload floodproofed structures; accordingly, in some substructures, this measure might induce flood-related losses greater than those without floodproofing protection. In addition, floodproofing measures are not dependable protection against fast-flowing, debris-laden floodwater. Although floodproofing in more economically applied to new construction, it is also applicable to existing structures. Implementation of floodproofing measures is the responsibility of individual property owners. Expenditures on protective measures by property owners is subsidized by partial Federal reimbursement of costs (Section 73, Public Law 93-251 entitled, "Water Resources Development Act of 1974). Even though floodproofing provides protection to buildings and properties, it affects their aesthetic appearance. Property exchange would still occur, however, such measures may have some effect on resale value. Floodproofing is difficult to implement in flood plain areas where there are many residences and commercial activities. Many of the older farm houses and buildings within the watershed are located on knolls or rises. Normally, this keeps the structures dry, although isolated for periods of time. Newer residential structures, however, even in rural areas, have not always been placed on higher ground and are more susceptible to damage. Therefore, floodproofing is more applicable to newer residential areas in the watershed. The time available for placing temporary floodproofing structures is dependent upon the flood warning time. In the upstream areas of the watershed, such as in Alexander and Attica, the warning time is normally too short to implement a flood warning system. In the areas downstream of Batavia, particularly in the Wolcottsville and Rapids area, there is adequate time to install temporary protective measures. Also, people would have to be available at the time to take temporary floodproofing actions. If floodproofing were implemented, flooding outside the protected area would still occur. Residual costs would be incurred by cleanup activities, damage to yards, gardens, agricultural fields, roads, utilities, and loss of time from those activities dependent on automobile transportation

(i.e. employment, shopping, education). Existing vegetation and wildlife habitat would still be inundated during Tonawanda Creek floods. Because floodproofing could be employed to serve some needs for flood management in the watershed, it is considered to be a potentially viable measure to complement a structural alternative. However, it is not considered a primary measure because of its lack of social acceptance. This is evidenced by the fact that nationally, floodproofing has not been accepted as the primary flood management objective.

6.10 The basic premise of the Federal Flood Insurance Program is that it would significantly reduce future flood damage potential within a community while compensating for existing damage, by requiring future construction and significant reconstruction to be at or above the 100-year flood elevation or be floodproofed. In addition, no construction which would retard flood flows is permitted within the floodway - described as the "channel proper and the accompanying floodplain area required to convey the 100-year discharge." By having flood insurance property owners would feel some degree of financial security. However, flood damages to existing structures and properties would still occur. Residual costs would be incurred by cleanup activities, damage to yards, gardens, farmlands, roads, utilities, and loss of time in those activities dependent on automobile transportation (i.e. employment, shopping, education). Flooding could cause some interruption of public services such as power, ambulance, police, and fire protection. With continued flooding, backflow of sanitary sewers into residential areas during flood periods could be a safety hazard to public health. Only those individuals that purchased flood insurance would be benefited after the flood event. However, this would not eliminate the clean-up required after the flood, nor the time and effort to replace damaged property. Existing vegetation and wildlife habitat would be inundated during floods. Since flood insurance requires no construction, existing environmental conditions would not be disturbed due to implementation of flood insurance. In the Flood Disaster Protection Act of 1973, Congress stipulated that a community having jurisdiction over lands susceptible to special flood hazards could receive Federal assistance, only provided it participate in the flood insurance program established by the 1968 National Flood Insurance Act. Because the Flood Disaster Act of 1973 may induce many persons owning flood-susceptible properties to purchase flood insurance, this measure may be used to supplement other possible combinations of flood management measures.

6.11 Development and implementation of flood plain regulations would control extent and types of future development in the flood plain. Without flood plain regulations, indiscriminate construction of new developments may increase future flood depths that could affect more properties and residents in the flood plain, as well as outside the periphery of the floodplain. Proper development of regulations in the Tonawanda Creek Watershed would: (a) permit flood compatible uses of the flood plain, (b) reduce the threat to public health and safety in time of flooding, (c) help reduce community and individual costs associated with evacuation, flood fighting, relief, rehabilitation, or construction of protective works, (d) offer protection from personal loss or injury that may result from flooding, (e) change the direction and amount of uncontrolled urban growth by limiting such growth in flood plain areas of low and high hazard, and redirecting development to safer

peripheral areas above or along the fringe of the flood plain. Flood plain regulation is essentially a nonstructural measure for community flood protection. Since construction equipment is not required to implement this measure, the existing environment would not be disturbed, other than by natural conditions that would continue to occur in the flood plain. Implementation of this nonstructural measure does not require expenditure of fuel energy. Flood plain regulations control or prevent further displacement and encroachment by structural development and incompatible land use on wildlife habitat and natural aesthetic sites. Even though some flood protection could be attained by implementation of flood plain regulations, flooding of existing structures and lands would still occur. Continued flooding on local unprotected transportation networks, public facilities and private properties would temporarily disrupt traffic flow, commercial activities, services, and employment of flooded areas. Erosion, silt, and debris deposition along unprotected areas would incur damage to existing natural vegetation, farmlands and residential areas. Use of heavy equipment would create noise, dust and mud during cleanup and hauling periods following flooding. Continued flooding could create problems to public health in the community. By implementation of regulations flood plain management within the watershed would be highly effective in those areas of the flood plain subject to frequent flood damage. Land use management would be under the control of local Governments.

6.12 Significant social, institutional, and physical problems make the practicability of permanent evacuation in the highly developed residential areas such as Amherst questionable. Community cohesion could be disrupted. This measure is unacceptable to many residents having strong historical ties to their homes and community; also, there would be personal inconvenience experienced by permanent evacuation, however, evacuated residents would no longer be living in the Tonawanda Creek flood plain. Although the aforementioned impacts are significant, this measure is considered to be feasible in the more rural, sparsely developed areas of the lower Tonawanda Creek Watershed. Most of the developed areas in Tonawanda Creek Watershed do not experience deep flooding, although flooding is frequent. Since evacuation is most effective in areas where flooding is frequent and of considerable depth, this measure alone does not adequately serve the need for flood damage management. The cost of permanent evacuation of people and structures is high, and adverse impact on existing community cohesion would be significant.

6.13 The Nonstructural Base Plan Alternative reduces existing average annual flood damage by about 40 percent. Residual average annual damages would be very high, and would require a great involvement by the community. The economic efficiency of this alternative plan, based on an economic life of 100 years and an interest rate of 6-1/8 percent, is 0.80. The average annual benefit of the Nonstructural Base Plan Alternative is $1,132,100, and the average annual cost is $1,415,500.

6.14 The Nonstructural Base Plan was not selected as the proposed plan of action for the following reasons: (a) existing fish and wildlife habitat in the floodlands of the Tonawanda Creek Watershed would continue to be subject to damage by floodwater; (b) operational dependability of the plan is

indeterminate; (c) permanent evacuation of 140 units would cause significant social, institutional, and physical problems; and (d) the plan is not economically justifiable, since the benefit-cost ratio is only 0.80.

ALTERNATIVE PLAN: SIERKS RESERVOIR - LINDER RESERVOIR

6.15 Description - This plan provides for construction of the Sierks Reservoir on Tonawanda Creek and the Linden Reservoir on Little Tonawanda Creek.

6.16 The Sierks Reservoir would be a storage reservoir on Tonawanda Creek in the Cattaraugus Hills, near the hamlet of Sierks. The reservoir would involve construction of an earth fill dam, a spillway constructed of reinforced concrete, and a pool normally having a maximum depth of approximately 87 feet and surface area of 1,050 acres. The dam would be located approximately 3 miles upstream from the village of Attica. The spillway would be located near the left (west) abutment of the dam. The spillway would be an ogee-shaped weir equipped with four manually operable tainter gates, having a capacity to discharge a maximum probable flow. Approximately 12,000 acre-feet of water would be stored at the level of the spillway crest. The Sierks Reservoir is depicted on Plate 6.2.

6.17 The Linden Reservoir would be a storage reservoir on Little Tonawanda Creek in the Cattaraugus Hills, near the hamlet of Linden. The Linden Reservoir would involve construction of an earth fill dam, an outlet works constructed of reinforced concrete, an emergency spillway excavated in natural soils formations, and a pool normally having a maximum depth of 63 feet and surface area of 1,015 acres. The dam would be located approximately 0.2 miles upstream from the hamlet of Linden. The outlet works would be located near the left abutment of the dam equipped with manually operable gates; and have a capacity to discharge a probable 100-year peak flow. The emergency spillway would be located in the right abutment of the dam and have capacity to discharge a maximum probable flow of 52,000 cubic feet per second. Approximately 22,900 acre-feet of water would be stored at the level of the spillway crest. The Linden Reservoir is depicted on Plate 6.3.

6.18 Socio-Economic and Environmental Impacts - This plan reduces flooding and associated damage in both floodlands outlined on Plate 1.2. It provides roughly 100-year protection in the Erie Plain Floodland, and a varying degree of protection in the Huron Plain. Installation of both reservoirs would provide greater protection than either the Sierks or Linden Reservoirs alone. The plan reduces existing average annual flood damage by about 48 percent. Residual average annual flood damages would be moderate. The economic efficiency of the plan, based on previously developed designs, an economic life of 100 years, and an interest rate of 6-1/8 percent, is 0.56. The plan would intercept runoff from tracts of the Cattaraugus Hills totalling about 82.7 square miles in area, and comprising much of the major source of runoff presently contributing to the flooding of the Erie Plain floodland. This tract represents approximately 48 percent of the Watershed above the city of Batavia, and 12.8 percent of the whole watershed. In addition to serving flood management, the plan would serve fishery enhancement,

recreation, provide low-flow augmentation and a source of water for irrigation.

6.19 The proposed sites of the Sierks and Linden Reservoirs have experienced earth quaking of intensity great enough to cause wet slopes to fail. Preliminary designs of the dams for these reservoirs do not account for the risk of earth quaking. Adequately designed dams would be far more costly. It is noted, however, that the economic efficiency of the plan, based on the less costly dams and flood management benefit only, is about 0.56.

6.20 As indicated in a letter dated 7 December 1975 from the Attica Town Planning Board, Sierks Reservoir does not comply with the town of Attica land use plan. The Sierks Reservoir would inundate State Route 98 south of Lindsley Road to a point just north of Varysburg; therefore, approximately 4.5 miles of this State Route would have to be relocated. Portions of several other town side roads would be permanently inundated by the project. Persons residing within the limits of the maximum probable flood pool on the Sierks Reservoir would have to relocate. About 26 families would be relocated and structures within this flood pool would be removed. Relocation from the potential flood pool of the Sierks Reservoir is unacceptable to those residents feeling strong historical ties to their homes and community. Movement to new areas would cause some hardship and inconvenience to persons affected by relocation. Construction of the Sierks Reservoir would alter the existing indigenous rural environment, by decreasing aesthetic landscape diversity and converting the rural natural and man-made physiographic valley features in the impoundment area, to a more open, broad, lake-type environment. Installation of the reservoir could cause growth of water-related recreation development about its periphery. The Sierks Reservoir would contain a substantial amount of deep water for a distance upstream of the dam. For the economic life of the project, existing farmland and wetlands within the 1,050-acre normal pool, would be inundated to considerable depth and lost from present use. This action would change existing land use and natural conditions in the immediate project locale by removing farmland from production, destroying natural vegetation, converting present terrestrial wildlife habitat to an aquatic habitat, and it would convert the existing meandering stream's rifflepool environment in the project site to an extensive area of open deep water. Existing fish and wildlife habitat would be unavoidably disrupted by heavy equipment work and installation of materials needed to construct the reservoir. Such work and materials would involve clearing and grubbing; excavation and filling related to construction of the dam and stilling basin; borrow material; line drilling; rock excavation; rock fill (toe drain and riprap); concrete for the spillway; installation of concrete piers (training walls and stilling basin); installation of steel reinforcement, tainter gates, slide gates, service bridge, and other miscellaneous items to get the job accomplished. It is probable that Sierks Reservoir, if constructed, would significantly affect a major deer wintering area in the Tonawanda Creek Valley, identified by wildlife biologists of the New York State Departmant of Environmental Conservation. Consequently, by disrupting the deer wintering area in the reservoir site, the Sierks measure could possibly affect the deer herd in a much larger area of the valley.

6.21 As indicated in a letter dated 16 December 1975 from the Genesee County Department of Planning, the Linden Reservoir would be important to the county because of its potential use as a source of water for developing a county-wide water supply system, and it would help control flooding in the towns of Bethany and Alexander. Construction of the Linden Reservoir would inundate a portion of two County roads (No. 1 and No. 4) and a town road (Thompson Road) in Wyoming County. Approximately a mile of county roadways would need to be relocated. Persons residing within the limits of the maximum probable flood pool of the Linden Reservoir would have to relocate to places outside these limits. About 23 families would have to be relocated and structures within these flood pools would be removed. Relocation out of the potential flood pool of the reservoir is unacceptable to many families, because of their strong ties to home and possibly to their community. Movement to new areas would cause some hardship and inconvenience to persons affected by relocation. A significant impact of the Linden Reservoir is that a cemetery now located on the south side of West Middlebury Road (just southwest of the intersection of Belknap Road and West Middlebury Road) would have to be relocated. Also, a small historical settlement in Middlebury would be inundated. Construction of the Linden Reservoir would alter the existing indigenous rural environment by decreasing aesthetic landscape diversity and converting the rural natural and man-made physiographic features in the impoundment area, to a more open, broad, lake-type environment. Installation of the reservoir measure could cause growth of water-related recreation development about its periphery. In general, local people feel that existing nearby recreation areas are not being utilized enough, and oppose further recreation development that would be provided by the reservoir. The Linden Reservoir would contain a substantial amount of deep water for a distance upstream of the dam. For the economic life of the project, existing farmland and wetlandd within the 1,015-acre normal pool, would be inundated to considerable depth and lost from present use. This action alters the project locale by removing farmland from production, destroying natural vegetation, converting present terrestrial wildlife habitat to an aquatic habitat, and converting the existing meandering stream's riffle-pool environment in the project site to an extensive area of open deep water. Existing fish and wildlife habitat would be unavoidably disrupted by heavy equipment work and installation of materials needed to construct the reservoir. Such work and materials would involve clearing and grubbing; excavation and filling related to construction of the dam and principal spillway, relocation of power lines, and other miscellaneous items to accomplish the task. Since existing stream conditions would be inundated to greater depths by construction of the Linden Reservoir, the present New York State Department of Environmental Conservation brown trout-stocking program in Little Tonawanda Creek area between West Middlebury and the hamlet of Dale would be affected. However, the reservoir would probably have value for naturally introduced and stocked fish species. If constructed, the reservoir's value as a fishery would have to be evaluated to determine the type of fish species best suited for the impoundment area.

6.22 The Sierks and Linden Reservoirs would have some value to waterfowl as a resting area during spring and fall migratory seasons. Aquatic emergent vegetation for use by waterfowl as food and cover would probably be sparse, because shoreline depths in general, would exceed water depths conducive to

much establishment of such aquatic plants. In addition to the initial expenditure of time, labor, fuel, and funds needed to construct the reservoirs, some annual expenditure of these resources would be required to manage and maintain this alternative plan. Some temporary unsightliness would occur in the project area during construction operations, and also during annual maintenance of the project. Some soil compaction by heavy equipment could be expected. Temporary erosion, stream turbidity, and sedimentation would be unavoidable during construction and maintenance periods. Use of heavy equipment for clearing, excavation, filling, and hauling of materials would cause temporary noise, mud, and dust in the general vicinity of the project site; this would include work activities on access roads and rights-of-way.

6.23 The Sierks Reservoir-Linden Reservoir Alternative Plan was not selected because its cost would far exceed the benefit it would provide; and it would result in overriding adverse environmental impacts.

ALTERNATIVE PLAN: SIERKS RESERVOIR AND ALABAMA RESERVOIR COMPOUND

6.24 Description - This plan provides for construction of the Sierks Reservoir on Tonawanda Creek and construction of the Alabama Reservoir Compound in the Huron Plain floodland. A description of the Sierks Reservoir was provided in paragraph 6.16.

6.25 The Alabama Reservoir Compound would be a complex of reservoirs including both storage and detention reservoirs, near the hamlet of Alabama in the adjacent Oak Orchard Creek Watershed (See Plates 6.1 and 6.4). It would include eight reservoirs (two storage reservoirs and six detention reservoirs) each provided by dikes; a diversion channel to convey floodwater from Tonawanda Creek to the storage reservoirs; internal principal outlet works to discharge water from the reservoir compound; one emergency spillway to discharge water from the compound; and periodically, two pools (one in each reservoir), each having a maximum depth of approximately 17 feet, and together having a maximum surface area of about 3,000 acres. Pool "A" (Storage Reservoir) and Pool "B" (Detention Reservoir) would occupy the northern part of the 5,500-acre Tonawanda Game Management Area. The dikes providing the reservoirs would include the existing embankments of Feeder Road, Meadville Road, and Wagoner Road (each would be modified as necessary) and several new earth fill embankments; would stand about 17 feet above the adjacent flood plain and together would extend approximately 72,600 feet. Modified existing embankments would extend about 27,000 feet; new embankments would extend about 45,600 feet. A trapezoidal-shaped diversion channel excavated in natural soils (to divert most of the flows of Tonawanda Creek in excess of about 1,250 cubic feet per second) would be located almost totally within the Tonawanda Indian Reservation, with its origin at Tonawanda Creek at a site about 0.4 miles northwest of the intersection of Judge and Poodray Roads. The diversion channel would extend from this site northward, to the storage reservoirs. The Alabama Reservoir Compound would include a constriction in the natural channel of Tonawanda Creek (a drop-spillway constructed of reinforced concrete, to provide the inlet for a diversion channel) to divert flood water to the storage reservoirs; and two training dikes to prevent floodwaters from by-passing the Compound. The two training dikes (constructed of earth fill; roughly 7 feet high) would be located on each

side of the Tonawanda Creek channel. One dike would extend about 2,000 feet southwestward from the channel constriction; the other about 1,500 feet northeastward from the constriction. Two internal outlet works constructed of reinforced concrete, would be located in the dike to be provided by the Meadville Road embankment. These outlet works would function to discharge water from the storage pools into the detention reservoirs during post-flooding periods. An internal emergency spillway would be provided in the dike including the Meadville Road embankment, and would function only during flooding to discharge excess water from the storage reservoirs to the detention reservoirs. There would be two external principal outlet works constructed of reinforced concrete. One outlet work would be located in the dike provided by the Meadville Road embankment (about 0.1 mile north of the intersection of Meadville and Klosen Roads), which would function to discharge water from the storage reservoirs to the Tonawanda Creek channel. The other outlet works would be located in the westernmost dike of the compound at its intersection with an existing ditch-tributary to the Mud Creek channel (about 0.4 mile southeast of the intersection of Lewiston and Ditch Roads), and would function to discharge water from the detention reservoirs, both during and after flooding, to the Mud Creek valley. An asphalt-lined external emergency spillway (bottom width of 3,000 ft.) would be constructed in the dike to be provided by the Meadville Road embankment. It would be located between the intersections of Klosen and Bartel Roads with Meadville Road, and would function only during flooding, discharging excess floodwater from the reservoir compound to the Tonawanda Creek valley.

6.26 Socio-Economic and Environmental Impacts - This alternative plan provides protection against flooding and flood damage in both floodlands shown in Plate 1.2. It would provide roughly 100-year degree protection in the Erie Plain floodland, and 200-year degree protection in the Huron Plain. This alternative plan would reduce existing average annual flood damage by roughly 84 percent. Residual average annual damages would be low. The economic efficiency of the Sierks Reservoir and Alabama Reservoir Compound alternative plan, developed design for the Sierks Reservoir, an economic life of 100-years, and an interest rate of 6-1/8 percent, is 0.96.

6.27 External flood damage effects of this alternative plan would be significant at the proposed site of the Alabama Reservoir Compound. The State of New York Department of Environmental Conservation and U. S. Fish and Wildlife Service have indicated their concern with regard to potential adverse impacts that the Alabama Reservoir Compound could have on fish and wildlife habitat, and on existing wetland management plans in the Tonawanda Game Management Area.

6.28 The diversion channel and training dikes associated with the Alabama Reservoir Compound, would alter about 45 acres presently in woodland and open shrub-herbaceous plant fields on the Tonawanda Indian Reservation. This alternative would take away land from the Indian Reservation and may affect the lifeways of Reservation inhabitants. Excavation of the diversion channel would change the existing appearance of the terrestrial landscape, and create an open ditch-like corridor through these fields that would have to be seeded and maintained in low growing vegetation. Existing wildlife habitat in the vicinity of the diversion channel and training dikes would be

unavoidably disrupted during construction. Construction work would include: excavation of a diversion channel about 1.3 miles in length, placement of suitable excavated material in the training dikes and impoundment dikes, spreading and grading of whatever material may be suitable for use in the dikes; installation of about 3,500 feet of training dikes to a height of about 7 feet; some constriction of the natural channel of Tonawanda Creek from about 60 feet to 44 feet, to divert excess creek flows into the diversion channel; placement of about 5,820 square yards of stone riprap in the vicinity of the diversion channel inlet, and construction of a concrete drop inlet spillway and appurtenant wall.

6.29 If the Alabama Reservoir Compound were constructed, approximately nine families residing within the limits of the perimeter dikes, or adjacent to the emergency spillways along Meadville Road, would be relocated. All structures within the area affected by the project would be removed. Relocation of families would disrupt community cohesion and is unacceptable to those residents feeling strong historical ties to their homes and community. Loss of land ownership in the flood plain and movement to new areas could cause some hardship and inconvenience to families affected by relocation. During floods great enough to fill the storage reservoir, those segments of Meadville Road providing the emergency spillways would be temporarily inundated. During vertical raising of Meadville Road and Judge Road, traffic would be temporarily rerouted until construction work was completed. Since the diversion channel would cut across Judge Road, a bridge would be built at this crossing point. Flooding across Meadville Road would be expected to occur in the vicinity of the external emergency spillways approximately once every 2 to 3 years.

6.30 The New York State Department of Environmental Conservation indicated, by letter dated 7 January 1976, that the Alabama Reservoir Compound has the greatest potential for creating adverse impacts on wetlands of the measures considered - especially with regard to wetlands and completed developments on the State-owned Tonawanda Wildlife Management Area. Pool A (the storage reservoir) and Pool B (the detention reservoir), would together temporarily provide a maximum flood pool surface area about 3,000 acres in size, in the northern portion of the management area. It is probable that water would be impounded in both the storage and detention reservoirs to depths of 17 feet during flooding. Such maximum water depths considerably exceeds desired water depths used in management of aquatic habitat on this area - particularly in management of aquatic plants used by waterfowl as food, cover and nesting habitat. If flooding occurs during nesting periods, the rise in water levels within the reservoirs would adversely affect nesting success of waterfowl, as well as any nests of other birds such as ring-necked pheasant, woodcock, and shore birds. In addition, since some of the water areas on these State-owned lands contain fish, flooding during the fish spawning season, would disrupt spawning success to some degree. The length of time deep water would stay in these reservoir depends upon the degree of flooding. After flooding, the excess water above desired levels would be drained in a few days. Present marshlands on the area support a variety of aquatic submergent, emergent, and floating vegetation, with interspersed pockets of open water that, together, provide good juxtaposition and

interspersion of habitat conditions desirable for use by waterfowl, shorebirds, furbearers, and warm-water fish species. Storage of spring floodwaters at depths that would occur in the proposed storage and detention reservoirs, even for short periods of time, would destroy or retard growth of aquatic plants that do not do well in deep water. Therefore, considering the aforementioned potential impacts, the Alabama Reservoir Compound would disrupt present and future NYSDEC developmental and management efforts on their wildlife managements lands, as well as affect recreation opportunities, such as hunting and observation of wildlife afield. It is also noted that, recently, the NYSDEC has extended time, labor, and funding to prevent damaging floodwaters from entering this management area. If water levels were raised above those desired for development and maintenance of marshland conditions, it would affect their land use plan. Should flooding of Pools A and B occur during the waterfowl food planting season of buckwheat, during the season of food crop emergence, or during the fall season of waterfowl migration, such management efforts could possibly be significantly affected. It is probable that, if the storage and detention pools were flooded during the hunting season, there would be a loss of recreation hunting opportunity for harvest of waterfowl and small game species. NYSDEC indicated that about 2,500 man-days are spent in hunter recreation on the Tonawanda Wildlife Management Area. Finally, it is possible that this flood management measure could affect habitat of several rare and endangered bird species that are sighted on occasions around the Iroquois National Wildlife Refuge and the State-owned wildlife lands. In addition to the initial expenditure of time, labor, fuel, and funds needed to construct the compound, outlet channel, and diversion channel, some annual expenditure of these resources would be required to manage and maintain this flood management measure. Some temporary unsightliness would occur in the project area during construction operations, and also during annual maintenance of the project. Some soil compaction by heavy equipment could be expected. Temporary erosion, stream turbidity, and sedimentation would be unavoidable during construction and maintenance periods. Use of heavy equipment for clearing, excavation, filling, and hauling of materials would cause temporary noise, mud, and dust in the general vicinity of the project site; this would include work activities on access roads and rights-of-way.

6.31 The environmental impacts of the Sierks Reservoir are discussed in paragraph 6.20.

6.32 The Sierks Reservoir and Alabama Reservoir Compound Alternative was not selected because its cost would far exceed the benefit it would provide, and because of the overriding adverse environmental impacts that might result.

ALTERNATIVE PLAN: ALEXANDER RESERVOIR

6.33 Description - This alternative plan would be a detention reservoir (normally dry) on Tonawanda Creek near the upstream limit of the Erie Plain, near the village of Alexander. The Alexander Reservoir is depicted in Plate 6.5. The Reservoir would have a dam provided adjacent to and downstream from an abandoned embankment of the Erie-Lackawanna Railroad extending across the flood plain between the limits of North Alexander and East Alexander. The

dam would have dimensions similar to those of the existing railroad embankment. A line of the Erie Railroad would pass through an opening in the dam. The opening would be temporarily closed during floods. The principal outlet works and emergency spillway of the reservoir would be located in the dam, near its intersection with the Tonawanda Creek channel. The spillway would be comprised of a weir with its crest near the elevation of the adjacent flood plain, and would be equipped with five manually operable tainter gates having a capacity to pass the Standard Project Flood. Approximately 6,750 acre-feet of water would be stored at the level of the spillway crest.

6.34 Socio-Economic and Environmental Impacts - The Alexander Reservoir alterntive plan would provide protection against flooding and flood damage in both major floodlands of the watershed, provide roughly 20-year degree protection in that part of the Erie Plain floodland downstream from it, and would provide incidental protection in the Huron Plain. This reservoir alternative would intercept runoff from a tract of the Cattaraugus Hills 102 square miles in area and comprising most of the major source of runoff presently contributing to flooding in the watershed. This tract represents approximately 59.3 percent of the watershed above the city of Batavia, and approximately 20.0 percent of the whole watershed. This alternative plan would reduce existing average annual flood damage by roughly 29 percent. Residual average annual damages would remain high throughout the watershed. Persons residing within the limits of the maximum probable flood pool in the Alexander Reservoir alternative would need to relocate to places outside these limits. About eight families would have to be relocated. Structures within these flood pools would also have to be removed. At the maximum probable flood pool elevation, this reservoir alternative would have a temporary surface area of about 945 acres. Terrestrial wildlife land would temporarily be inundated during such flooding periods. The flood pool created by this measure would occur over an area that naturally floods under existing conditions; however, the area flooded by the Alexander Reservoir would temporarily flood a somewhat larger acreage. In addition to the initial expenditure of time, labor, fuel, and funds needed to construct this reservoir alternative, some annual expenditure of these resources would be required to manage and maintain this flood management measure. Some temporary unsightliness would occur in the project area during construction operations, and during annual maintenance of the project. Some soil compaction by heavy equipment would be expected. Temporary erosion, stream turbidity, and sedimentation would be unavoidable during construction and maintenance periods. Use of heavy equipment for clearing, excavation, filling, and hauling of materials would cause temporary noise, mud, and dust in the general vicinity of the project site; this would include work activities on access roads and rights-of-way. In order to construct the dike associated with the Alexander Reservoir alternative, approximately 22 acres of land would be stripped. Of this total, 10 acres of land would be cleared and grubbed, and about six wetland acres would be filled in. During flood periods, portions of roadways and the Erie Railroad within the reservoir would be temporarily inundated, thereby precluding use of these transportation routes until floodwater subsided.

6.35 The economic efficiency of the plan, based on an economic life of 100 years and an interest rate of 6-1/8 percent, is 1.15. The average annual

net benefit of the plan is $113,200. Although the Alexander Reservoir alternative is economically justifiable, protection it would provide in the watershed is too low. Therefore, it was not selected as the proposed plan of action.

ALTERNATIVE PLAN: BATAVIA RESERVOIR

6.36 Description - This alternative plan would be a detention reservoir (normally dry) on Tonawanda Creek adjacent to the upstream limit of the city of Batavia. The Batavia Reservoir alternative is depicted in Plate 6.6. This reservoir alternative would have a dam provided adjacent to and upstream from an embankment of the Lehigh Valley Railroad extending across the flood plain there. The dam would stand roughly 7 feet higher than the railroad embankment. A line of the Erie Railroad would pass through an opening in the dam. The opening would be equipped with a gate and would be closed temporarily during flooding. The outlet works of the reservoir would be located in the dam near its intersection with the Tonawanda Creek channel, and they would be comprised of three sluiceways located side-by-side, which would be operated to pass no more than 3,000 cubic feet per second during flooding. The emergency spillway of the reservoir would be located in a saddle in the divide between the Tonawanda Creek valley and adjacent Bowen Creek Watershed, near the intersection of State Route 98 and Dodgeson Road. Bowen Creek is a small tributary of Tonawanda Creek, joining it downstream from the city of Batavia and near the village of East Pembroke. The spillway would be a grassed channel. It would be 5,000 feet wide and would have capacity to pass the probable maximum flow. Approximately 70,000 acre-feet of water would be stored at the crest of the emergency spillway.

6.37 Socio-Economic and Environmental Impacts - The Batavia Reservoir alternative plan would provide protection against flooding and flood damage in both floodlands of the watershed. It would provide roughly Standard Project Flood protection for that part of the Erie Plain floodland downstream from it, and a varying degree of protection in the Huron Plain. The plan would reduce existing average annual flood damage by about 53 percent, with moderate residual average annual damage. The economic efficiency of the alternative plan, based on an economic life of 100 years and an interest rate of 6-1/8 percent, is 0.93.

6.38 The Batavia Reservoir alternative plan is not acceptable to those who would have to accommodate it. Generally, parties who would be affected contend that the plan would require excessive detrimental change in land use and local environment. Land to be used for the reservoir would be bought and possibly leased. Persons residing within the limits of the maximum probable flood pool in the Batavia Reservoir alternative would relocate to places outside these limits. Land used by the reservoir would include about 6,460 acres of principally farmland, wetland, and woodland. A total of 82 residences, seven farms and four construction industries would have to be purchased and removed. Relocation out of the potential flood pool would be unacceptable to many residents because of their strong ties to home and possibly to their community. Movement to new areas may also cause some hardship and inconvenience to persons affected by relocation. At the maximum probable

flood pool elevation, this reservoir alternative would have a temporary surface area of 6,460 acres. Wildlife land would temporarily be inundated during such flooding periods. In addition to the initial expenditure of time, labor, fuel, and funds needed to construct the reservoir, some annual expenditure of these resources would be required to manage and maintain this flood management measure. Some temporary unsightliness would occur in the project area during construction operations, and during annual maintenance of the project. Some soil compaction by heavy equipment would be expected. Temporary erosion, stream turbidity, and sedimentation would be unavoidable during construction and maintenance periods. Use of heavy equipment for clearing, excavation, filling, and hauling of materials would cause temporary noise, mud, and dust in the general vicinity of the project site; this would include work activities on access roads and rights-of-way. In order to construct the dike associated with the Batavia Reservoir alternative, approximately 80 acres of land would have to be stripped. Of this total, 34 acres would be cleared and grubbed, and about six wetland acres would be filled in. During flood periods, portions of roadways and the Erie Railroad within the reservoir would be temporarily inundated, thereby precluding use of these transportation routes until floodwater subsided.

6.39 The Batavia Reservoir alternative was not selected as the proposed plan of action, because it does not provide a net benefit, and it is socially unacceptable to those residents who would accommodate it.

ALTERNATIVE PLAN: BATAVIA RESERVOIR AND ALABAMA RESERVOIR COMPOUND

6.40 Description - This alternative plan provides for the construction of both the Batavia Reservoir and Alabama Reservoir Compound. The Alabama Reservoir Compound was previously described in paragraphs 6.25 and the Batavia Reservoir was described in paragraphs 6.36. See Plates 6.4 and 6.6.

6.41 Socio-Economic and Environmental Impacts - Paragraphs 6.27 through 6.30 described probable impacts of the Alabama Reservoir Compound, and paragraphs 6.37 through 6.39 described probable impacts of the Batavia Reservoir. This alternative plan would provide protection against flooding and flood damage throughout both floodlands of the Watershed. It would provide roughly Standard Project Flood protection in that part of the Erie Plain floodland and in the Huron Plain floodland. This alternative plan would reduce existing average annual flood damage by about 91 percent. Residual average annual damages would be minimal. The economic efficiency of this alternative plan, based on an economic life of 100 years and an interest rate of 6-1/8 percent, is 1.11. It would provide a net benefit of $320,500. Effects of this alternative plan would be significant at the proposed site of the Alabama Reservoir Compound. The State of New York Department of Environmental Conservation and U. S. Fish and Wildlife Service indicated their opposition to this plan, due to the serious adverse impacts that the Alabama Reservoir Compound would have on fish and wildlife habitat, and on existing wetland management plans in the Tonawanda Game Management Area.

6.42 This alternative plan was not selected as the proposed plan of action because of the adverse impact on lands and inhabitants within the Tonawanda Indian Reservation and adverse effects on State-owned fish and

wildlife lands that would be significant. Further, it is socially unacceptable to residents that would have to accommodate this plan.

ALTERNATIVE PLAN: BATAVIA PROJECT MODIFICATION

6.43 Description - This plan provides for construction of the Batavia Project Modification of Tonawanda Creek in the city of Batavia and vicinity downstream. See Plate 6.7. On 3 February 1958, a report on a study to determine the feasibility of improving flood management along Tonawanda Creek in the vicinity of Kibbe Park, within the city of Batavia, was submitted to the Chief of Engineers. Of work considered, reconstruction of a levee in the vicinity of the park, and extension of that levee approximately 1,940 feet, northward along the creek to Chestnut Street was found to be economically feasible. Although the District and Division Engineers recommended this work, the Chief of Engineers directed that the study be expanded to address fully the authorized resolution adopted by the Public Works Committee of the House of Representatives 23 July 1956. Further consideration of the recommended work was, therefore, deferred temporarily. On 16 February 1962, a report on a study to determine the feasibility of providing improved flood management in Tonawanda Creek Watershed was submitted to the Chief of Engineers. Of work considered, that found to be feasible included: construction, similar to that described above, to provide a levee to extend from an embankment of the former New York Central Railroad near the southern limit of the city of Batavia, northward approximately 3,200 feet along the creek, to Chestnut Street; protection of the left bank of the creek channel over a distance of approximately 1,300 feet from a small municipal dam on the creek, upstream, within the city of Batavia; and enlargement and protection of the creek channel over a distance of approximately 2-1/2 miles from the downstream end of the reach of channel improved by the Corps in 1956 (as described subsequently), to the village of Bushville. See Plate 6.7. Based on this report, higher authority recommended that alternative plans including regional measures be considered.

Socio-Economic and Environmental Impacts

6.44 This alternative plan would provide protection against flood damage in the vicinity of the city of Batavia only. It would provide roughly a 25-year protection in the western part of the city of Batavia, and downstream through the village of Bushville. However, the 25-year protection would give a false sense of security to area residents, since flooding would still occur. Alteration of this plan to provide Standard Project Flood protection, would require extensive reconstruction in the city of Batavia and in the vicinity downstream. Homes, businesses, public facilities, and a historic landmark (The Holland Landmark Company Office) would probably have to be relocated; also, cost to provide Standard Project Flood protection would be prohibitive. The economic efficiency of this alternative plan, based on an economic life of 100 years and an interest rate of 6-1/8 percent, is 2.67. Its average annual net benefit is $217,100. Channelization would disrupt about 60 acres in the immediate project area, and levee construction would disrupt about 18 more acres; also, about 1,300 linear feet of stone riprap would be installed along the west bank downstream of the former New York Central Railroad tracks. This construction would alter the existing aquatic

stream habitat and adjacent terrestrial wildlife habitat. Elimination of riparian vegetation would reduce wildlife cover, runways and nesting sites for birds and mammals, and would remove some sources of leaf litter and falling insects that are part of the food chain for aquatic life. Shallower water depths due to channel bottom widening, combined with removal of shade cover along the creek banks, would permit water temperatures to become higher - particularly during the summer when lower flows are normally expected. Many large overhanging shade trees that now contribute to the aesthetic appearance of Tonawanda Creek would be eliminated by channelization, levee; and riprap construction. Some temporary unsightliness would occur in the project area due to construction disturbance of terrain during grubbing and clearing operations; during seedbed preparation of denuded soils; during the pre-emergent growth period of seeded areas, and also during annual maintenance of the project. Some soil compaction by heavy equipment would be expected. Temporary erosion, stream turbidity, and sedimentation is unavoidable during construction and maintenance periods. Use of heavy equipment for clearing, excavation, filling, placement of riprap and hauling of materials causes temporary noise, mud, and dust in the general vicinity of the project site, on access roads and rights-of-way.

6.45 The Batavia Project Modification alternative was not selected as the proposed plan of action because it would only provide local protection in the city of Batavia. The degree of protection would be low, and it would have a significant adverse impact upon the aquatic environment and adjacent streambank riparian vegetation.

ALTERNATIVE PLAN: BATAVIA RESERVOIR COMPOUND

6.46 Description - This plan is quite similar to the selected plan described in Chapter 1 of this FEIS. In fact, the selected plan is actually a modification of the Batavia Reservoir Compound (BRC) Plan. The Batavia Reservoir Compound, shown on Plate 6.8, would consist of two shallow detention reservoirs (normally dry) arranged in series. The plan would require construction of two earth dams, each with its own principal and emergency spillways and several low dikes. Snags and debris jams in the channel of Tonawanda Creek within the compound area would be removed to insure natural channel capacity of approximately 2,000 cubic feet per second. The two reservoirs would include a tract of roughly 4,840 acres within the floodland between the village of Alexander and the city of Batavia. The upper dam would be adjacent to, and downstream from, an embankment of the Erie-Lackawanna Railroad, and would stand approximately as high as the embankment. A line of the Erie Railroad would pass through an opening in this dam. The opening would be equipped with an electrically operable floodgate which would be closed temporarily during flooding. The principal outlet works of the upper reservoir would be located in its dam, at or near its intersection with the Tonawanda Creek channel. These outlet works would include five closed conduits, side-by-side, each equipped with an electrically operable gate. The lower dam would be adjacent to and upstream from the Lehigh Valley Railroad embankment. It would extend along the railroad embankment from near State Route 98 to near Ellicott Street. A line of the Erie Railroad would also pass through an opening in this dam. This opening

would be equipped with an electrically operable floodgate which would be closed temporarily during flooding. Low dikes would be constructed adjacent to Ellicott Street between the Lehigh Valley Railroad embankment and Shepard Road, and in two draws adjacent to State Route 90 near its intersection with the railroad embankment. The principal outlet works of the lower reservoir would be located in the dam adjacent to the existing railroad bridge over the creek. They would include four closed conduits, side-by-side, each equipped with an electrically operable gate.

6.47 Socio-Economic and Environmental Impacts - The Batavia Reservoir Compound Plan would control runoff from the upper 172 square miles (33.7 percent of the whole watershed). This tract includes all the major sources of runoff - the Cattaraugus Hills - contributing to flooding in both floodlands of the watershed. This plan would provide flood protection to roughly the 10-year level in the tract of the Erie plain floodland between the upper and lower dam. Total flood protection would be provided for the city of Batavia and village of Bushville. The Compound would provide roughly 50-year protection in the Huron Plain floodland.

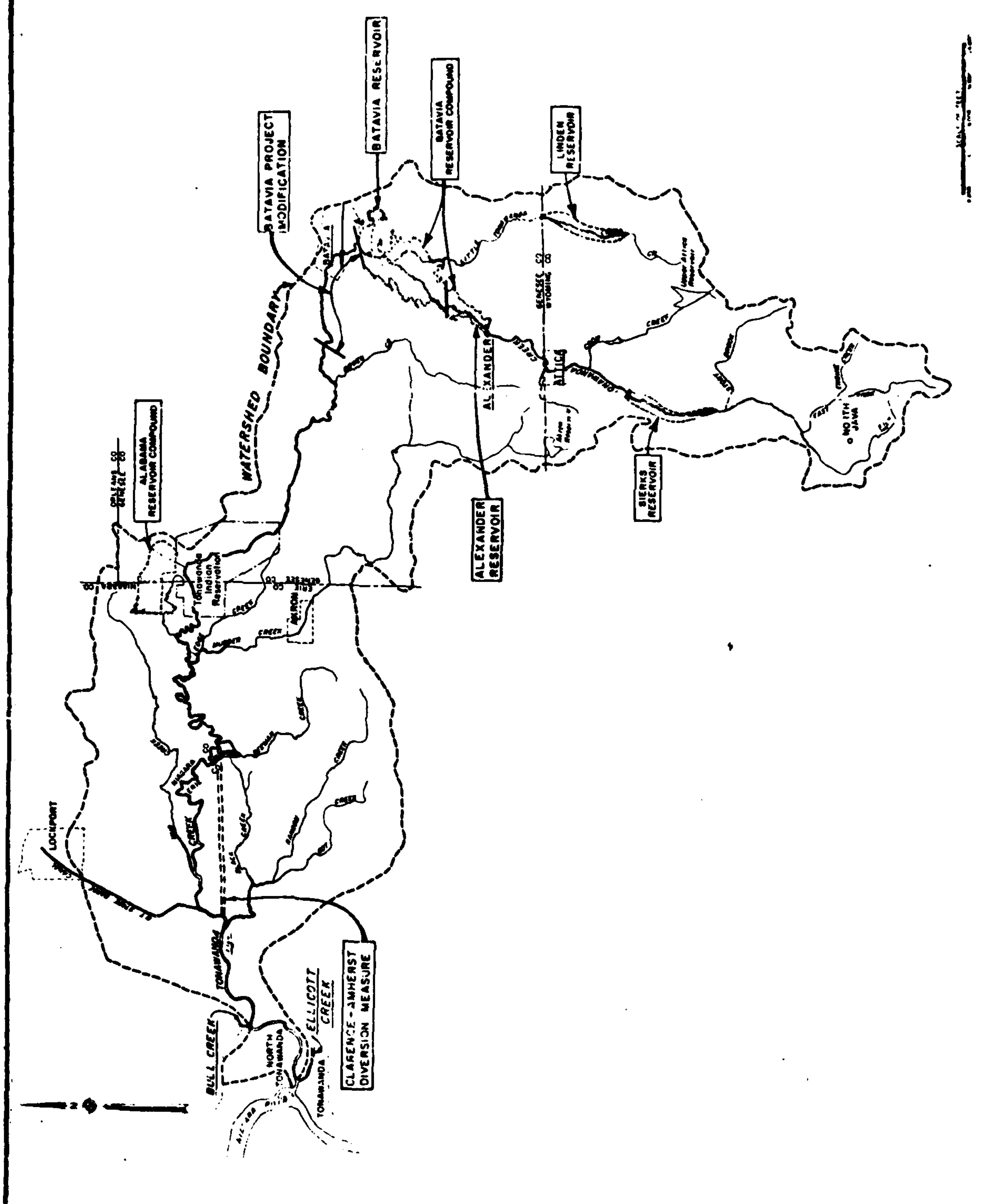
6.48 Land to be used for the upper reservoir would include about 940 acres of farmland, wetland, and woodland. This land would be purchased. No buildings are located within this tract; however, 10 buildings situated along Railroad Avenue in the village of Alexander might be included within the headwater fringe of floodpools caused by maximum probable flooding. These 10 buildings include two town equipment sheds and eight residences. The town sheds would remain. The eight residences would be purchased and removed. These eight buildings comprise all buildings in the village of Alexander susceptible to frequent flood damage.

6.49 The emergency spillway of the lower reservoir would be located in a saddle in the divide between the Tonawanda Creek valley and adjacent Bowen Creek Watershed, near the intersection of State Route 98 and Dodgeson Road. Bowen Creek is a small tributary of Tonawanda Creek, joining it downstream from the city of Batavia near the village of East Pembroke. The spillway would have capacity to discharge the probable maximum flow. Land to be used for the emergency spillway would include roughly 1,730 acres of farmland, wetland, and woodland. Part of this land would likely be flooded approximately once in 500 years. All of this land would be flooded only by the probable maximum flood. Whatever water passed would flow generally along the course of Bowen Creek to rejoin Tonawanda Creek just east of the town of East Pembroke. Because of the rare need to use the emergency spillway, land used for it would be left with private owners who would grant easements permitting possible flowage on it. No buildings would have to be relocated.

6.50 Land to be used for the lower reservoir would include roughly 3,900 acres of principally farmland, wetland, and woodland. This land would be protected by the upper reservoir from flooding of up to 10-year frequency. The land would remain with private owners who would grant easements permitting possible flooding of it. A total of approximately 32 residence and 3 farmsteads would have to be purchased.

6.51 The BRC Plan has a benefit-to-cost ratio of 1.46 based upon an interest rate of 6-1/8 percent and a 100-year economic lifetime. The average annual net benefit of the plan is $616,000. Advanced geotechnical and hydrological investigations determined that it was infeasible to construct the BRC Plan in the areas considered (due to poor foundation and possible earthquake problems), therefore, the plan was reformulated into the Batavia Reservoir Compound Plan.

6.52 A Clarence-Amherst Diversion Measure that would provide local protection was also considered. This measure would include a diversion channel, an associated dike, and two associated levees. The channel would be located in the towns of Clarence and Amherst; would extend from the Tonawanda Creek channel, near its junction with Beeman Creek, approximately 7 miles along an east-west course south of Tonawanda Creek to near its junction with Ransom Creek; and would conduct flood flows of Tonawanda and Black Creeks to the New York State Barge Canal. See Plate 6.1. The dike would be located in the town of Clarence and would divert flood flows of Black Creek to the diversion channel, and then to Tonawanda Creek. The two levees would prevent overland flow from the Tonawanda Creek valley and the Beeman Creek Watershed, into the Black Creek Watershed. This local protection measure would be of 25-year frequency and would benefit parts of the towns of Clarence and Amherst only. Operation of the Clarence-Amherst Diversion Measure would likely worsen flooding upstream from its flow-training entrance dikes, and it would tend to increase flows in the Tonawanda Creek channel downstream from it and increase the risk of flooding in adjacent highly developed areas. Because this measure would provide only limited protection in the Huron Plain and would cause significant external flood damage and tend to increase flows downstream from it, it is not considered a viable local protection measure. Further, increased water levels behind the levees would tend to hold water higher and somewhat longer than under existing conditions. Accordingly, this measure was not considered further.




Tonawanda Creek, New York

WATERSHED MAP SHOWING LOCATIONS OF STRUCTURAL MEASURES CONSIDERED

Plate 6.1

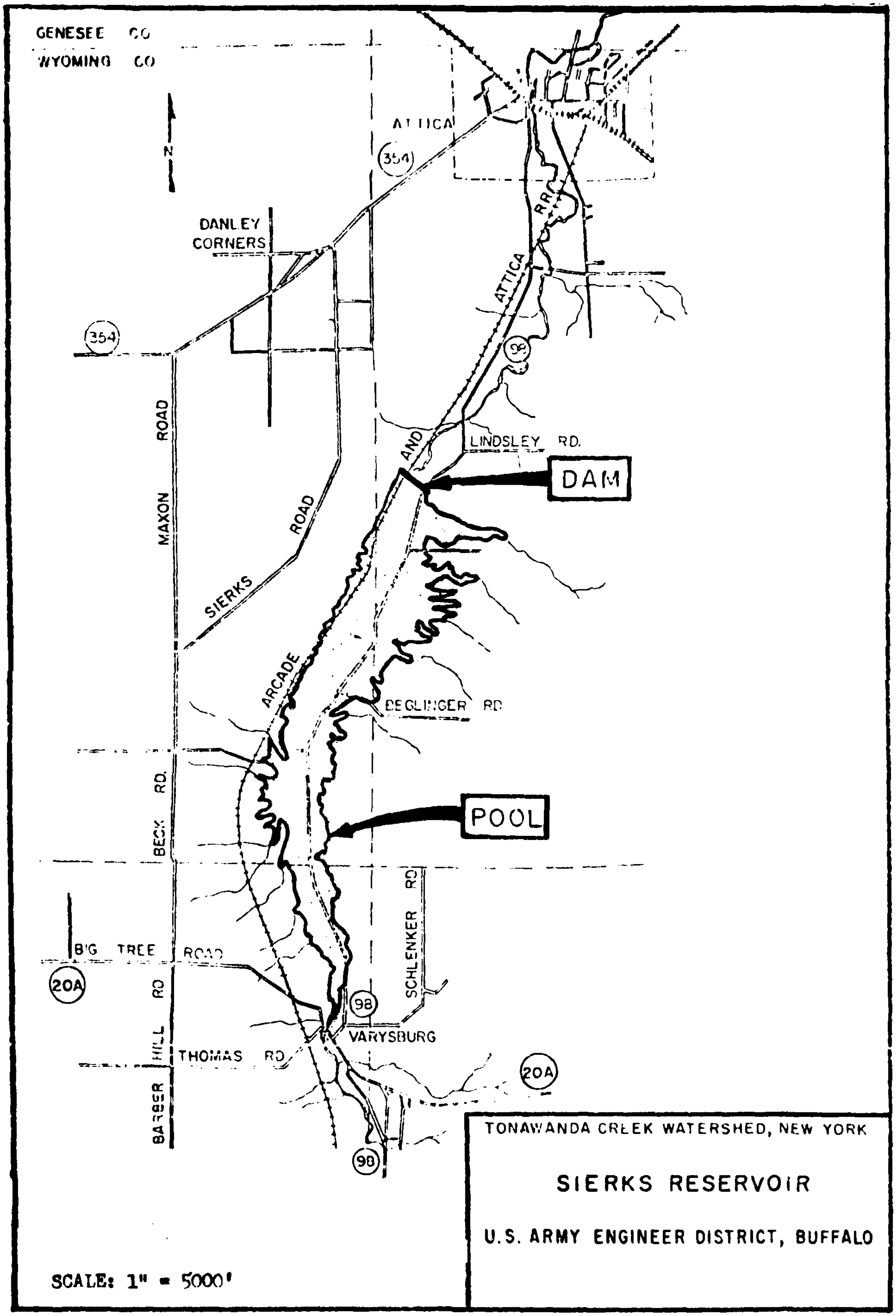
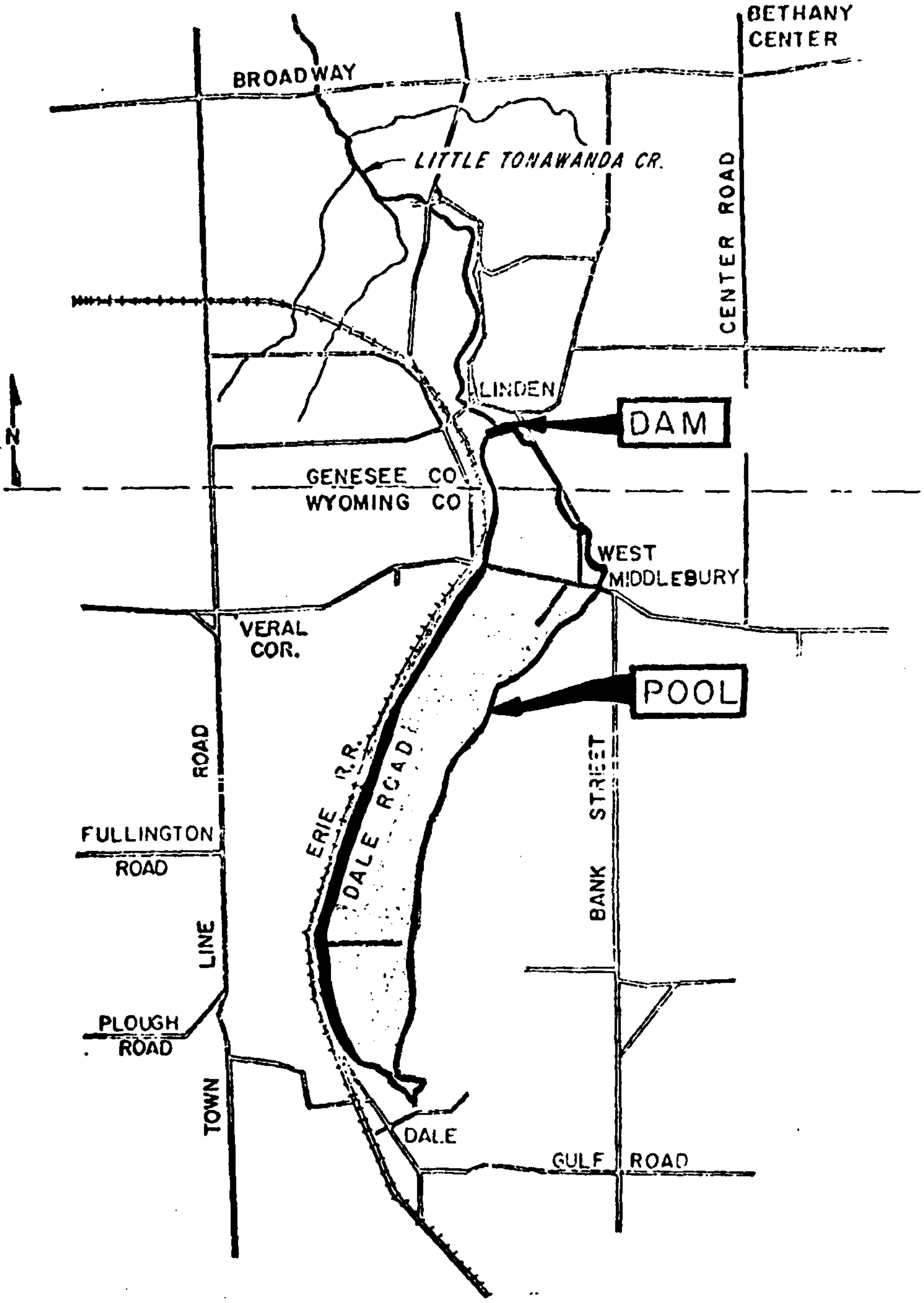

GENESEE CO
WYOMING CO
N
ATTICA
354
DANLEY
CORNERS
RR
ATTICA
AND
ARCADE
98
LINDSLEY RD.
DAM
MAXON ROAD
SIERKS ROAD
BEGLINGER RD
POOL
BECK RD.
SCHLENKER RD
BIG TREE ROAD
20A
BARBER HILL RD
98
VARYSBURG
THOMAS RD
TONAWANDA CREEK WATERSHED, NEW YORK
SIERKS RESERVOIR
U.S. ARMY ENGINEER DISTRICT, BUFFALO
SCALE: 1" = 5000'



PLATE 6.2




TONAWANDA CREEK WATERSHED, NEW YORK

LINDEN RESERVOIR

U.S. ARMY ENGINEER DISTRICT, BUFFALO

SCALE: 1" = 5000'

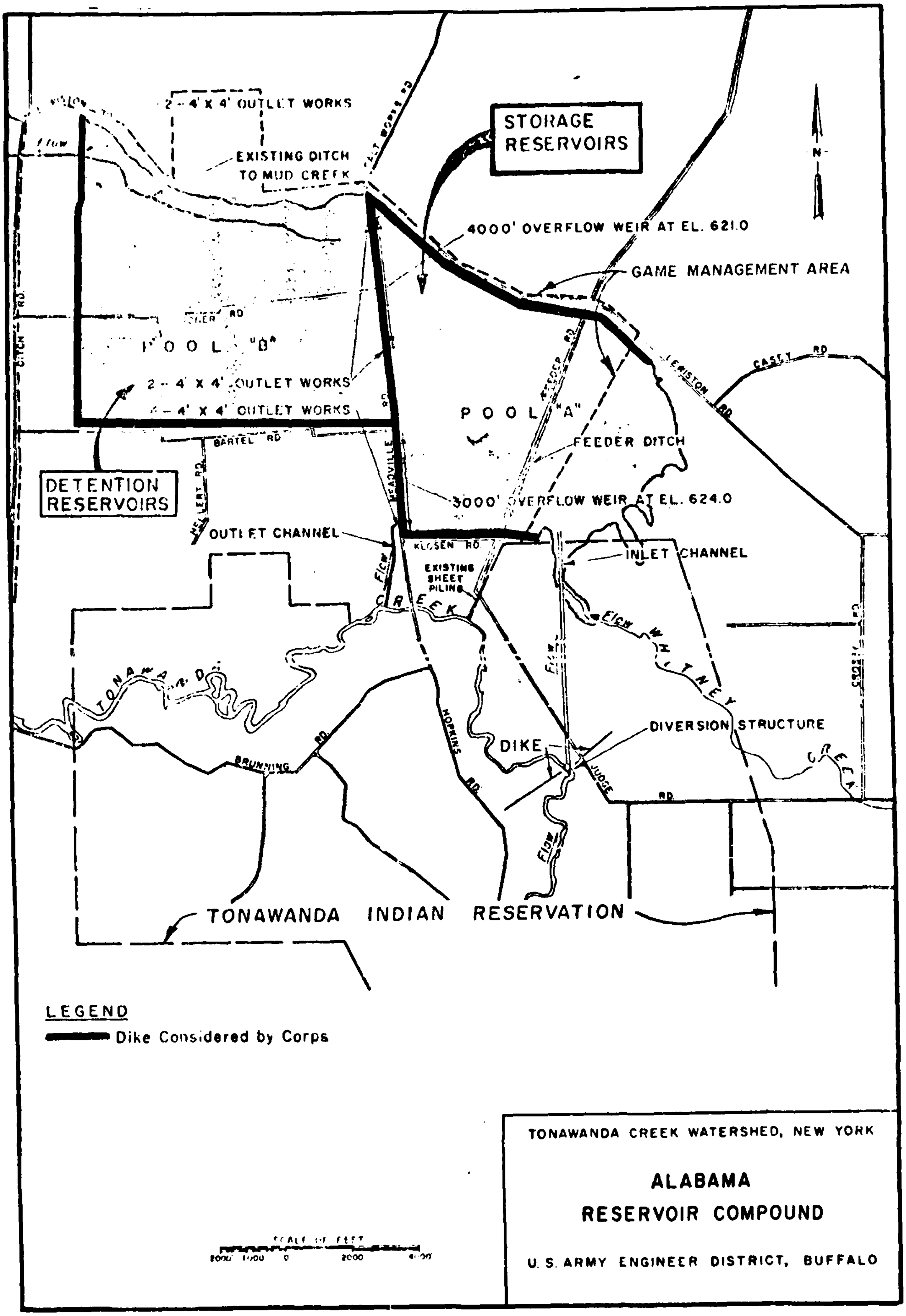
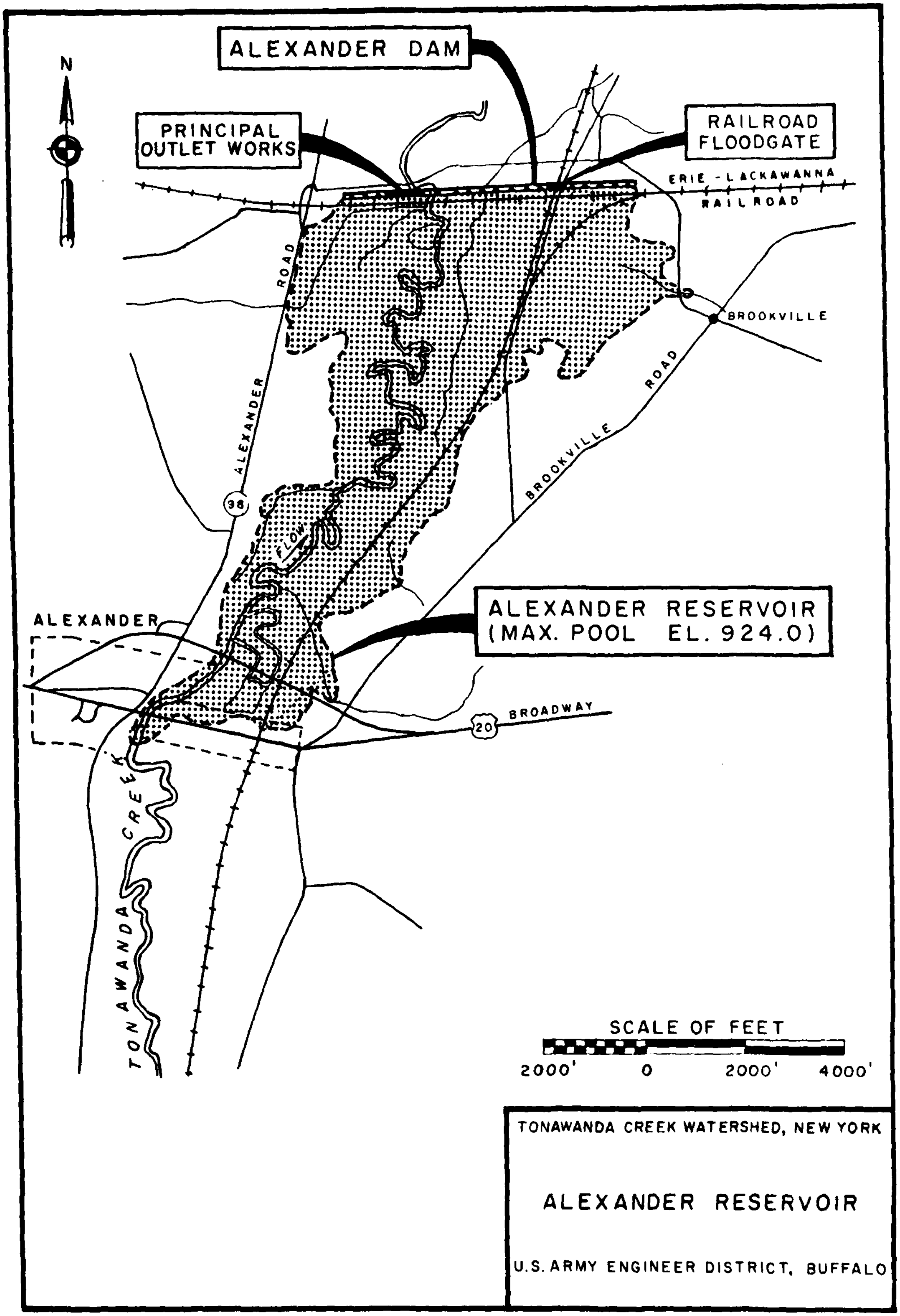
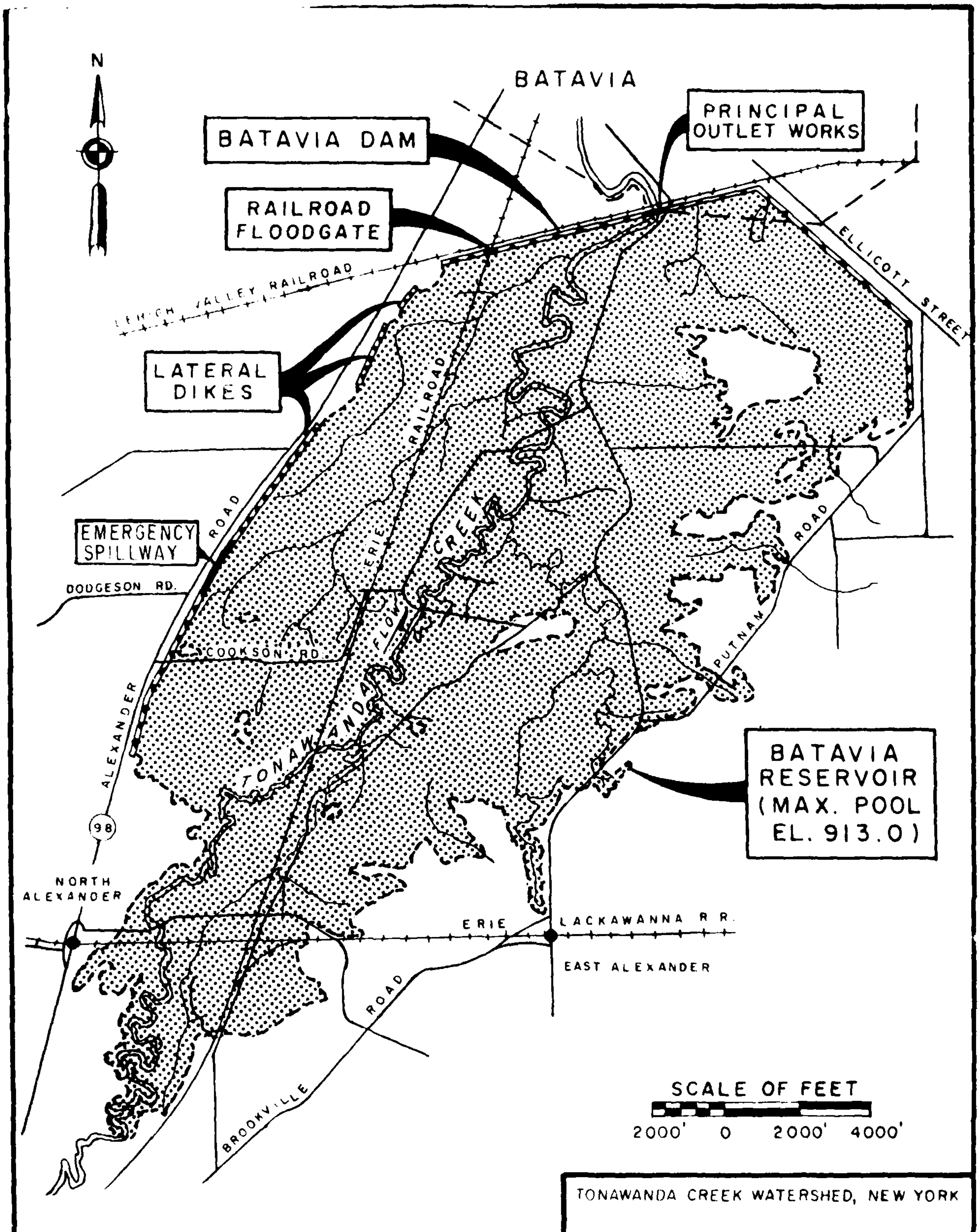

2 - 4' X 4' OUTLET WORKS
EXISTING DITCH TO MUD CREEK
STORAGE RESERVOIRS
4000' OVERFLOW WEIR AT EL. 621.0
GAME MANAGEMENT AREA
POOL "B"
2 - 4' X 4' OUTLET WORKS
4 - 4' X 4' OUTLET WORKS
POOL "A"
FEEDER DITCH
DETENTION RESERVOIRS
3000' OVERFLOW WEIR AT EL. 624.0
OUTLET CHANNEL
KLOSEN RD
INLET CHANNEL
EXISTING SHEET PILING
TONAWANDA CREEK
WHITNEY CREEK
DIVERSION STRUCTURE
DIKE
BRUNNING RD
HOPKINS RD
JUDGE RD
CASEY RD
LEWISTON RD
BARTEL RD
MEADVILLE RD
TONAWANDA INDIAN RESERVATION
LEGEND
Dike Considered by Corps
TONAWANDA CREEK WATERSHED, NEW YORK
ALABAMA
RESERVOIR COMPOUND
U.S. ARMY ENGINEER DISTRICT, BUFFALO



PLATE 6.4

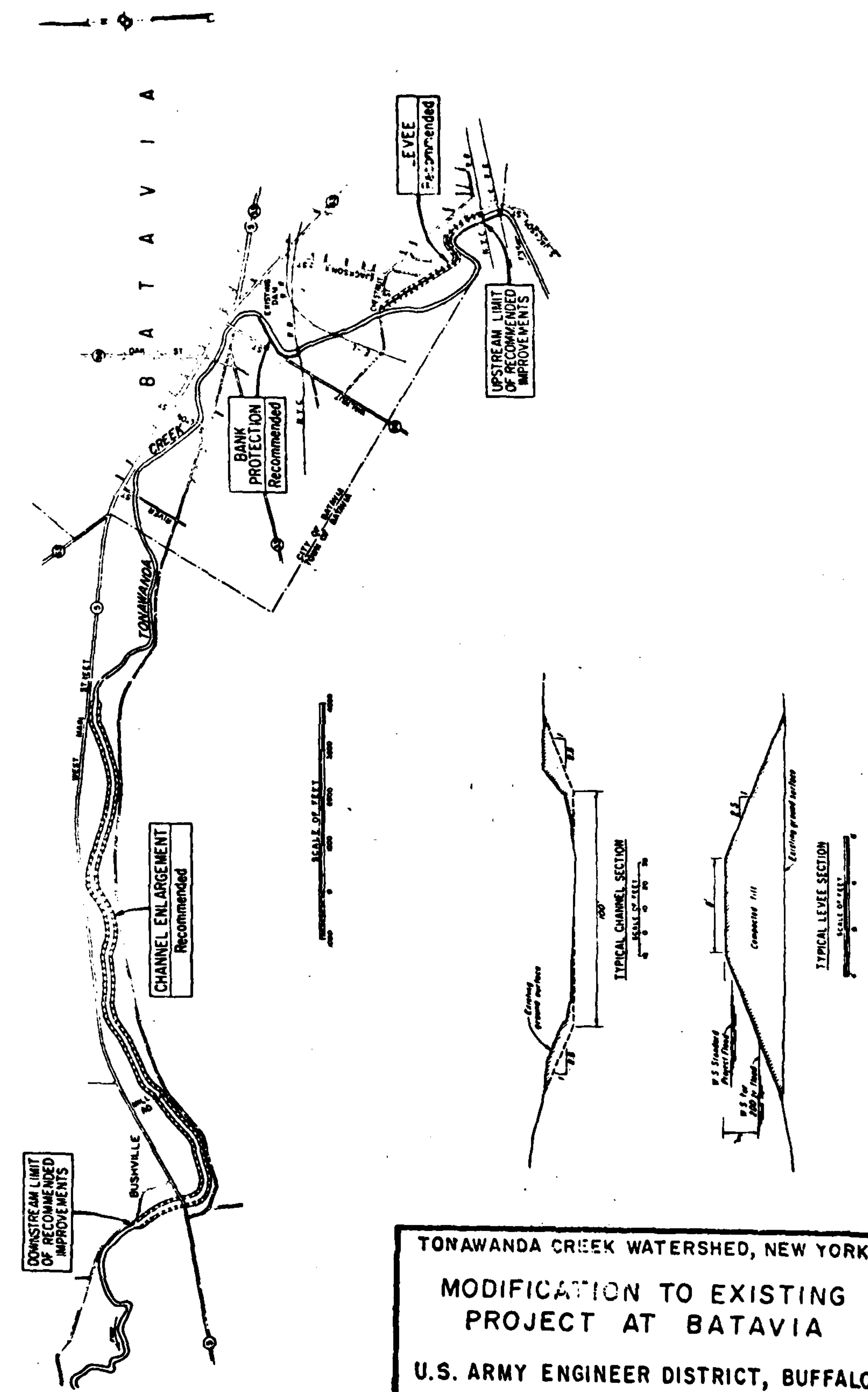

ALEXANDER DAM
PRINCIPAL OUTLET WORKS
RAILROAD FLOODGATE
N
ERIE - LACKAWANNA RAILROAD
ALEXANDER ROAD
98
BROOKVILLE
BROOKVILLE ROAD
FLOW
ALEXANDER RESERVOIR (MAX. POOL EL. 924.0)
ALEXANDER
20
BROADWAY
TONAWANDA CREEK
SCALE OF FEET
2000' 0 2000' 4000'
TONAWANDA CREEK WATERSHED, NEW YORK
ALEXANDER RESERVOIR
U.S. ARMY ENGINEER DISTRICT, BUFFALO




TONAWANDA CREEK WATERSHED, NEW YORK

BATAVIA RESERVOIR

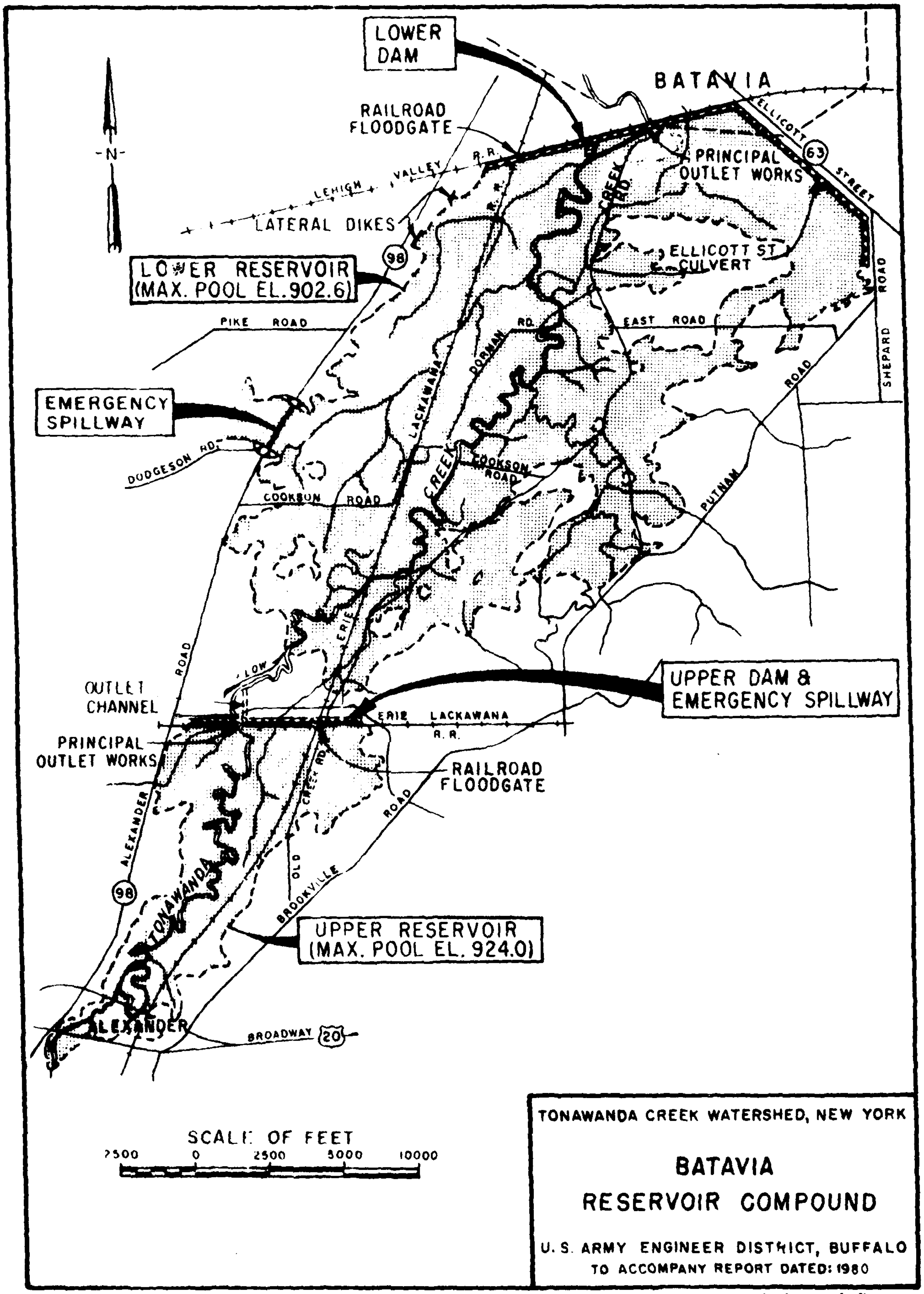
U.S. ARMY ENGINEER DISTRICT, BUFFALO




TONAWANDA CREEK WATERSHED, NEW YORK

MODIFICATION TO EXISTING PROJECT AT BATAVIA

U.S. ARMY ENGINEER DISTRICT, BUFFALO


LOWER DAM
BATAVIA
RAILROAD FLOODGATE
PRINCIPAL OUTLET WORKS
ELLICOTT STREET
63
LEHIGH VALLEY R.R.
CREEK RD
LATERAL DIKES
ELLICOTT ST CULVERT
98
LOWER RESERVOIR (MAX. POOL EL. 902.6)
N
PIKE ROAD
DORMAN RD.
EAST ROAD
SHEPARD ROAD
ROAD
EMERGENCY SPILLWAY
LACKAWANA
DODGESON RD.
CREEK
COOKSON ROAD
COOKSON ROAD
PUTNAM
ERIE
ROAD
FLOW
OUTLET CHANNEL
UPPER DAM & EMERGENCY SPILLWAY
ERIE LACKAWANA R.R.
PRINCIPAL OUTLET WORKS
RAILROAD FLOODGATE
ALEXANDER
OLD CREEK RD
ROAD
98
TONAWANDA
BROOKVILLE
UPPER RESERVOIR (MAX. POOL EL. 924.0)
ALEXANDER
BROADWAY
20
SCALE OF FEET
2500 0 2500 5000 10000
TONAWANDA CREEK WATERSHED, NEW YORK
BATAVIA
RESERVOIR COMPOUND
U. S. ARMY ENGINEER DISTRICT, BUFFALO
TO ACCOMPANY REPORT DATED: 1980

66 a

PLATE 6.8

## 7. THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

7.01 In order to evaluate the environmental relationships that can be expected to occur as a result of implementing flood management within the Tonawanda Creek Watershed, the following definitions have been applied:

(a) "Local Short-term Uses" are defined as construction operation and maintenance activities within the Tonawanda Creek Watershed, and the impacts of these activities.

(b) "Man's Environment" includes the physical, biological, economic, and social components influencing the human community.

(c) "Maintenance and enhancement of long-term productivity" is defined as the promotion of future activities or conditions beneficial to the natural and human environments expected to occur within the effective lifetime of the Tonawanda Creek Watershed flood protection plan, estimated to be 100 years.

7.02 Flood management, the chief objective of the proposed project, would be attained. Control of natural floods would significantly reduce flood damages to human and natural areas within the watershed. Threats to loss of life and property would be considerably reduced. The human population of the Tonawanda Creek Watershed would be assured of flood control; that is, residential commercial and industrial developments within the watershed would be assured a moderate amount of flood control. This positive effect could and probably would lead to greater development of these human resources within the Watershed. Damage and cleanup costs from natural flooding would be considerably reduced if the proposed project is constructed.

## 8. ANY IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES WHICH WOULD BE INVOLVED IN THE PROPOSED ACTION SHOULD IT BE IMPLEMENTED.

8.01 Implementation of the proposed project would result in the expenditure or elimination of various natural and human resources. In order to evaluate resource commitments that can be expected to occur as a result of proposed project activities with the Tonawanda Creek Watershed, the following definitions are made:

(a) "Irreversible or irretrievable commitments" are defined as those commitments of resources for periods no less than 50 to 100 years.

(b) "Natural Resources" are defined as the physical and biological components identified in Chapter 2, including climate, physiography and topography, geology, soils, terrestrial vegetation, terrestrial wildlife, aquatic vegetation, aquatic invertebrates and fisheries. "Human Resources" are defined as those environmental components directly associated with man's activities, including land and water use, transportation, structures and utilities, public services and facilities, industry and business, employment and income, recreation, demography and cultural resources.

8.02 Included as irretrievable commitments of resources should the project be implemented are the following:

(a) Materials used in embankment, dike, and outlet structure construction.

(b) Labor, fuel, and time used in embankment, dike, and outlet construction.

(c) Energy expended in operation of the outlet works.

(d) Labor, fuel, and time expended in clearing and snagging operations along the Tonawanda Creek, as well as commitments of labor, fuel, and time in annual project maintenance.

(e) Time, materials, and labor used in the various nonstructural measures of the proposed project.

(f) Approximately 44 acres of wetland, within the Tonawanda Creek Watershed would be filled in by dike and embankment construction.

(g) There would be minor losses of aesthetic quality within the project locale, due to construction of additional man-made construction features of existing topography.

(h) Clearing and stripping of approximately 126 acres of land during construction.

## 9. COORDINATION

9.01 Public Participation - A public meeting was held on 20 November 1975, at the Batavia High School Auditorium in Batavia, NY, to present preliminary alternative plans for flood management in the Tonawanda Creek Watershed. About 100 persons attended the meeting. Of those attending, 15 speakers formally presented views on the preliminary plans. Transcripts of this public meeting are available at the Buffalo District office. Public workshops were also held on 24 February 1976 (Alexander Fire Hall) and on 25 February 1976 (Town Hall in the city of Batavia), to obtain local views on the Batavia Reservoir Compound alternative. During the workshop meetings, the Corps explained how the Batavia Reservoir Compound would operate, and how property and easement acquisition would be handled. A similar workshop was also held for local governmental officials on 12 March 1976, at the County Legislative Chamber, County Building, at Main and Court Street in Batavia, NY. A fourth workshop meeting was held in Pendleton to discuss alternative flood management plans with officials in the lower Tonawanda Creek area.

9.02 Late Stage Public Meetings - Two late stage public meetings were held during November 1979 to present the modified plan for the Batavia Reservoir Compound to concerned individuals and groups. The meeting of 8 November 1979 was held in the city of Batavia, NY, and jointly coordinated by the Corps and the city of Batavia and Genesee County. The meeting of 16 November 1979 was held in Clarence, NY, and jointly coordinated by the Corps and the Erie-Niagara Counties Regional Planning Board. The meetings were informal and no transcripts of the meeting were made.

9.03 Land Use Coordination - Twenty-five Federal, State, and local land use planning agencies were contacted by the Buffalo District to determine the relationship of the proposed project to any land use plans and proposals they might have under consideration. Comments from these agencies are discussed in Chapter 3 of this Final Environmental Impact Statement.

9.04 Fish and Wildlife Coordination - In response to the lack of biological data about the areas that would be impacted by construction of the Batavia Reservoir Compound, the Buffalo District and the Cortland Field Office of the U. S. Fish and Wildlife Service jointly conducted fish and wildlife field studies of the area. The majority of the field work was conducted during the spring and summer of 1979. The Fish and Wildlife Service uses the data gathered for preparation of an official Fish and Wildlife Coordination Act Report. The Buffalo District uses the data to prepare this FEIS under the National Environmental Policy Act (NEPA). The Final U. S. Fish and Wildlife Service Report, dated 23 October 1980, contained a number of recommendations for the Batavia Reservoir Compound (modified). This report and final recommendations result from a previous report by U. S. Fish and Wildlife Service dated 16 April 1980, and a meeting between Fish and Wildlife Service, Buffalo District, and New York State Department of Environmental Conservation personnel on 2 June 1980.

9.05 The U. S. Fish and Wildlife Service Coordination Act Report contains 13 separate recommendations. [1/] These recommendations will be repeated in brief here and the Corps of Engineers responses to the recommendations will be discussed.

a. Recommendation 1 - The Fish and Wildlife Service has requested that a system of managed/natural flood control be given full consideration as a project alternative. The Corps does not feel it is prudent to delay further review and processing of the Final Feasibility Report and FEIS for Tonawanda Creek in order to study such an alternative. This is primarily based upon the Corps judgment, and current knowledge of the basin, that such a plan would be neither economically justified nor acceptable to property owners. Such a plan could not provide regional flood control such as provided by the Batavia Reservoir Compound (modified). Provision of regional flood control in the Tonawanda Creek Basin is the primary objective of this study. The Corps will consider developing and evaluating such a plan during post-authorization planning.

b. Recommendation 2 - The Fish and Wildlife Service recommends post-construction studies of the project's impacts on fish and wildlife and resources. The Corps will consider conducting such studies, through the Corps Research and Development Program, if the project is constructed.

c. Recommendation 3 - The Fish and Wildlife Service recommends that a plan be developed to minimize project-induced erosion siltation, and water pollution in Tonawanda Creek by the joint efforts of several agencies. The Corps normally develops such plans during Advanced Engineering and Design of a project. Such plans are developed to minimize siltation, erosion, and water pollution. The appropriate Federal and State agencies will be kept fully advised of the Corps plans on the matters discussed in this recommendation.

d. Recommendation 4 - The Fish and Wildlife Service has recommended that the dam's outlet works to be modified to permit upstream-downstream fish passage during nonflood periods. The Corps will modify the outlet works where appropriate and necessary to permit fish passage. The actual details of such modification will be determined during the design of the project and will be coordinated with the Fish and Wildlife Service and other concerned agencies.

e. Recommendation 5 - The Fish and Wildlife Service has recommended that instream construction activities be limited to certain low flow periods. The Corps will comply with this recommendation.

f. Recommendation 6 - The Fish and Wildlife Service recommends that a joint plan be developed for removal of snags from Tonawanda Creek. The actual determination of how snags will be removed from Tonawanda Creek will

[1/] See U. S. Fish and Wildlife Service Coordination Act Report dated 23 October 1980, pages 23-26 (Appendix A, Section A-1)

not be determined until Plans and Specifications are prepared for the project. The Corps will minimize the adverse effects of snag removal to the maximum extent possible. The Corps will also coordinate efforts on the preparation of plans for snag removal and clearing operations for the project with the Fish and Wildlife Service and other appropriate agencies during the advanced engineering and design of the project.

g. Recommendation 7 - The Fish and Wildlife Service has recommended that the proposed disposal sites be maintained as conservation pools. The Corps cannot currently accept this recommendation as no alternative feasible disposal sites are known. However, the Corps will investigate alternative disposal sites during post-authorization studies when more data are available on the type and total volume of spoil that will be generated by project construction.

h. Recommendation 8 - The Fish and Wildlife Service recommends that disturbed areas be replanted and monitoring of revegetated areas be jointly conducted and funded at project cost. The Corps accepts this recommendation in principal, however, the Corps cannot fund other agencies' participation in the development of revegation plans or in any monitoring activities.

i. Recommendation 9 - The Fish and Wildlife Service recommends that flood waters be retained in the reservoirs for the shortest possible periods of time and that plans for operation of the reservoirs be jointly developed by the Corps, Fish and Wildlife Service, and NYSDEC, and that any other agency that might take over operation of the reservoirs adhere to such plans. The gates of the two dams of the compound will be operated to retain water for the shortest period of time consistent with the primary purpose of providing regional flood control and downstream flood management. The project is completely a Federal project and as such, will be operated by the Corps and not turned over to another agency. The Corps will consider any suggestions by the Fish and Wildlife Service and NYSDEC regarding operation of the dams as long as they don't seriously compromise the primary flood control purposes of the project.

j. Recommendation 10 - The Fish and Wildlife Service has recommended that certain wetland complexes within the lower floodpool be protected with lateral dikes and flapgates. The Corps has determined that such protective structures could not be built economically nor would they provide the type of protection required.

k. Recommendation 11 - The U. S. Fish and Wildlife Service has recommended that about 665 acres of wildlife habitat areas (wetlands) be obtained to compensate for projected project-induced habitat losses and that such purposes be authorized as part of the project. The projected losses are based upon the Habitat Evaluation Procedures (HEP) analysis discussed in Fish and Wildlife Coordination Act Report. Due to problems with the HEP analysis and the fact that Corps policy requires that an alternative (traditional) mitigation analysis must be presented with a HEP analysis, the Buffalo District prepared a separate mitigation analysis. This analysis is based upon projected losses of fish and wildlife habitat from both construction and operation of the project. The entire analysis is contained in Appendix A, Section

A-6 of this FEIS. The alternative analysis has concluded that about 711 acres of compensation wetlands should be obtained to offset projected losses of habitat from construction and operation of the project. The Buffalo District has recommended that the project be authorized to include provisions for obtaining 711 acres of compensation wetlands in close proximity to the project area. The Corps will turn these lands over to the NYSDEC if requested, however, the Corps currently has no authority to fund State wildlife agencies for the administration (operations and maintenance) of such areas.

l. Recommendation 12 - The Fish and Wildlife Service has recommended that certain improvements for public access to the reservoir areas be incorporated as part of the project. During post-authorization studies, the Corps will further develop plans for providing public access to the reservoir areas. The contingency cost in the project estimates is sufficient to provide such access improvements as the Fish and Wildlife Service has recommended.

m. Recommendation 13 - The Fish and Wildlife Service has recommended that all mitigation activities be jointly performed by the Corps, Fish and Wildlife Service, and the NYSDEC. At the present time, the Corps does not have the authority to fund other agencies for such activities.

9.06 Cultural Resources Coordination - In response to the lack of data about cultural resources in the Batavia Reservoir Compound project area the Buffalo District contracted with the anthropology department of the State University of New York at Binghamton. The purpose of this contract was to perform a reconnaissance level cultural resources investigation of the project area. The field and literature search efforts were conducted during the summer and early fall of 1979. A preliminary report has been submitted to the Buffalo District and as of August 1980 has been reviewed by the District, the State Historic Preservation Officer (SHPO), the State Archaelogist, and the Heritage, Conservation, and Recreation Service. Appendix F of this FEIS gives more details on the cultural resources investigations and coordination.

9.07 Relationship of the Proposed Plan to Executive Order 11988 - Flood Plain Management - It is the Corps of Engineers policy, in relationship to Executive Order 11988 - Flood Plain Management, dated 25 May 1977, as described in ER 1165-2-26, to avoid development in a base (100-year) flood plain wherever possible. The general objective is to avoid, to the maximum extent possible, long- and short-term adverse impacts associated with the occupation and modification of a base flood plain whenever there is a practicable alternative to such an action. The Corps policy is to:

a. Avoid development in the base flood plain unless it is the only practicable alternative.

b. Reduce the hazards and risks associated with floods.

c. Minimize the impacts of floods on human safety.

d. Restore and preserve the beneficial values of the base flood plain.

9.08 In relationship to EO 11988 and general guidance contained in the ER 1105-2-200 series of Corps Regulations, several alternatives were developed for the primary planning objective of providing flood protection to affected persons, residences, and manufacturers in the Tonawanda Creek Watershed. Chapters 1 and 6 of this FEIS describe these alternatives in detail. The nonstructural base plan, described in Chapter 6, recommends a number of measures including flood warning, floodproofing, flood insurance, flood plain regulation, and permanent evacuation and is the plan that avoids development on the base flooding. As described in Chapter 6, this plan's operational dependability is suspect and is not economically justified. All of the structural plans involve construction in the base flood plain, although these structures are designed to provide flood control and should not be seriously damaged by flooding. The Batavia Reservoir Compound has been determined to be the best structural plans from engineering and environmental standpoints. Secondary development, induced by the project in the base flood plain, can be minimized by effective flood plain management by communities in downstream areas.

9.09 Therefore, the Corps has concluded that there is no practicable alternative to the proposed action which will occur in the base flood plain of Tonawanda Creek and that the recommended action (construction of the Batavia Reservoir Compound) is in conformance with Executive Order 11988 - Flood Plain Management.

9.10 Relationship of the Proposed Plan to Executive Order 11990 - Protection of Wetlands - It is the Corps of Engineers Policy, in relationship to Executive Order 11990 - Protection of Wetlands, dated 24 May 1977, and various Corps of Engineers Regulations, to avoid development that will directly or indirectly effect wetlands, unless no practicable alternative to such development exists, and the development is necessary. Construction of dikes and embankments will result in the loss of about 44 acres of wetland. This is a small percentage of the approximately 1,000 acres of wetland that occur within the limits of the Batavia Reservoir Compound. The results of the Feasibility Study for the Tonawanda Creek Study has concluded that construction of the Batavia Reservoir Compound is the best plan, generally speaking is the only practicable plan, and overall has more environmental quality enhancement measures than any of the plans considered. Therefore, the Corps has concluded that no practicable alternative to the Batavia Reservoir Compound exists and that construction of the project is needed for flood control purposes. Therefore, construction of the Batavia Reservoir Compound, even though it will directly affect about 44 acres of wetland, is in conformance with Executive Order 11990 - Protection of Wetlands.

9.11 Section 404 - Section 404(r) of the Clean Water Act of 1977 requires that, if possible, the evaluation of the discharge of dredged or fill materials into waters of the United States be included in an Environmental Impact Statement submitted to Congress pursuant to the National Policy Act of 1969 prior to the authorization of that project for construction or an appropriation of funds for construction of the project. Corps of Engineers Circular EC 1105-2-104, Implementation of Section 404(r) of the Clean Water Act, provides instructions on options for the Section 404(r) process. For the Batavia Reservoir Compound (Modified), the Buffalo District

has selected Option A as defined in the circular. Option A does not seek an exemption from implementing the Section 404 guidelines, specifically providing a Section 404(b)(1) evaluation, as part of the authorization process. The Buffalo District realizes that with such a major project as the Batavia Reservoir Compound (Modified) changes made during the Phase I General Design Memorandum studies, conducted after Congressional authorization, would render a Section 404(b)(1) done at this time invalid. Therefore, the Buffalo District has selected Option A as defined in EC 1105-2-104 and will conduct a Section 404(b)(1) evaluation during Phase I AE&D studies when this FEIS will be updated or redone.

9.12 Draft Environmental Impact Statement Coordination - The Draft Environmental Impact Statement presenting the Batavia Reservoir Compound as the selected plan was distributed to the agencies, individuals, and groups listed below for review and comment on 4 May 1976. At the same time, the DEIS was filed with the Council on Environmental Quality and notice of availability was recorded in the Federal Register dated 14 May 1976 commencing the official 45-day review period.

- Federal Energy Administration
- U. S. Department of Health, Education and Welfare, Region II
- U. S. Environmental Protection Agency
  - Region II Office
  - Rochester Field Office
- U. S. Department of Interior
  - Office of Environmental Project Review
  - Bureau of Indian Affairs
- U. S. Department of Commerce
- U. S. Department of Transportation
- U. S. Soil Conservation Service
- U. S. Forest Service
- U. S. Department of Housing and Urban Development
- U. S. Bureau of Outdoor Recreation
- Great Lakes Basin Commission
- Federal Highway Administration, Region I
- Honorable J. L. Buckley, U. S. Senator
- Honorable B. B. Conable, Jr., U. S. Representative
- Honorable Jack Kemp, U. S. Representative
- Honorable Henry J. Nowak, U. S. Representative
- Advisory Council on Historic Preservation
- National Park Service
- New York State Department of Transportation
- New York State Parks and Recreation Department
  - Director of Environment Management
  - Bureau of Recreation Planning
- New York State Office of Planning Services
- New York State Historic Preservation Officer
- New York State Department of Commerce
  - Program Planning Analyst
  - Division of Industrial Services and Technologies

New York State Department of Transportation
Office of Planning and Development
Program Analysis Bureau
New York State Urban Development Corporation
Program Development Division
Project and Environmental Impact Statement Review
New York State Department of Environmental Conservation
Office of Environmental Analysis
Director of Water Resources Planning
New York State Department of Health
Sierra Club - Niagara Group
Trout Unlimited (Western NY Chapter)
Izaak Walton League of America
League of Women Voters (Erie Co.)
League of Women Voters (Genesee Co.)
League of Women Voters (Niagara Co.)
Buffalo Audubon Society
The National Wildlife Federation
Northwestern University (Center for Urban Affairs)
National Audubon Society (Central Midwest Regional Office)
Center for Environmental Management (Cornell University)
Erie-Niagara Counties Regional Planning Board
Erie County Department of Planning
Genesee County Department of Planning
Attica Town Planning Board
Batavia City Planning Board
Batavia Town Planning Board
Pembroke Town Planning Board
Stafford Town Planning Board
Genesee County Health Department
Department of Environmental Quality of Erie County
Erie County Laboratory (Public Health Division)
Tonawanda Indian Reservation
Mr. Koichiro J. Yagi, (SUNY)
Dr. James R. Spotila, (SUC)
Ms. Kathleen Hassan
Dr. Wayne Hadley, (SUNY)

9.13 Comment - Response - The commenting letters on the Draft Environmental Impact Statement for the Tonawanda Creek study and corresponding Corps response appear on the following pages. Each commenting letter has been separated into specific comments and numbered along the left hand margin of the letter. Corps responses to each comment can be found by referring to the corresponding number to the right of each letter of comment.

# Great Lakes Basin Commission

Frederick O. Rouse
Chairman

3475 Plymouth Road
Post Office Box 999
Ann Arbor, Michigan 48106
313/763-3590 FTS: 374-5431

May 13, 1976

Mr. Byron G. Walker, LTC
Deputy District Engineer
Buffalo District
U.S. Department of the Army
1776 Niagara Street
Buffalo, New York 14207

Dear Mr. Byron Walker:

1. We appreciate the opportunity to review and comment on the draft Environmental Impact Statement on the proposed project for flood control in the Tonawanda Creek Watershed, New York, as enclosed in your letter of May 4, 1976. We have reviewed the draft Environmental Impact Statement and find that we have no substantive comments to make at this time.

2. The final report of the Great Lakes Basin Framework Study will be completed around October 1976. While the final Report will contain general recommendations for the Great Lakes Basin, it will not include recommendations for site-specific projects.

Sincerely,

Robert W. Reed
Water Resources Planner



CORPS RESPONSES TO THE GREAT LAKES BASIN COMMISSION
(Letter Dated 13 May 1976)

1. No response necessary.

2. No response necessary.

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
REGION ONE
New York Division Office
Leo O'Brien Federal building, Ninth Floor
Albany, New York 12207

May 27, 1976
IN REPLY REFER TO
01-36.2

Mr. Byron G. Walker
Deputy District Engineer
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Dear Mr. Walker:

We have reviewed the Draft Environmental Impact Statement on Flood Management in the Tonawanda Creek Watershed, transmitted with your May 4, 1976 letter, and offer the following comments:

1. In general, greater protection will be afforded to the various Federal-aid highways in the project area as a result of the proposed construction. However, two important area routes, State Route 98 and U.S. 20, might be subject to more frequent flooding after the upper reservoir is constructed.

2. The final environmental impact statement should specifically address the changes in flooding frequency on these two routes if the project is implemented. If the frequency does increase, then the grade of these two routes should be raised to provide the same protection as now exists.

Sincerely yours,

for Victor E. Taylor
Division Administrator

## CORPS RESPONSES TO THE U. S. DEPARTMENT OF TRANSPORTATION
(Letter dated 27 May 1976)

1. The Corps concurs that greater protection will be afforded to the various Federal-aid highways in the project area as a result of the proposed project.

2. Based on available information, the present design of the upper reservoir should decrease the frequency of flooding on State Route 98 and Federal Route 20. However, should the Corps determine during further study that the present design would increase the frequency of flooding on these two highways, then the Corps would change the design or raise the roads, or both, so that the frequency of flooding would be no greater than now.

United States Department of the Interior
BUREAU OF INDIAN AFFAIRS
EASTERN AREA OFFICE
1951 Constitution Avenue NW.
Washington, D.C. 20245

IN REPLY REFER TO:

CORPS RESPONSE TO THE U.S.D.I. - BUREAU OF INDIAN AFFAIRS
(Letter dated 4 June 1976)

JUN 4 1976

Colonel Bernard C. Hughes
District Engineer
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Dear Colonel Hughes:

Reference is made to the Draft Environmental Impact Statement on the proposed Project for Flood Control in the Tonawanda Creek Watershed.

1. This office has determined that the Batavia Reservoir Compound, the selected plan, will have no adverse impact on Indian Trust land.

Sincerely yours,

Harry A. Rainbolt

Harry A. Rainbolt
Area Director, Eastern Area Office

1. No response necessary.

United States Department of the Interior

BUREAU OF MINES

4800 FORBES AVENUE
PITTSBURGH, PENNSYLVANIA 15213

CORPS RESPONSES TO THE U.S.D.I. - BUREAU OF MINES
(Letter dated 4 June 1976)

June 4, 1976

Colonel Bernard C. Hughes
District Engineer
Buffalo District, Corps of Engineers
Department of the Army
1776 Niagara Street
Buffalo, New York 14207

Dear Sir:

Re: Draft Environmental Statement for the Interim Report on Feasibility of Flood Management in Tonawanda Creek Watershed; Erie, Genesee, Niagara, and Wyoming Counties, New York

We have reviewed the draft environmental statement concerning the construction of two detention dams in Genesee County, New York, for the purpose of flood control.

1. Mineral resources occurring in the project area are sand and gravel, limestone, dolomite, and gypsum, of which only sand and gravel is currently being produced, while limestone, gypsum, and natural gas are produced outside the project area.

2. The project should have little effect on the recovery of mineral resources or mineral potential of the area. The statement satisfactorily describes impact of the project on minerals. We therefore offer no suggestion for revision or addition to the statement.

Sincerely yours,

Robert D Thomson

Robert D. Thomson, Chief
Eastern Field Operation Center

1. No response necessary.

2. No response necessary.

## CORPS RESPONSES TO THE SIERRA CLUB - NIAGARA GROUP
(Letter dated 7 June 1976)

June 7, 1976

LTC. Byron G. Walker
Department of the Army
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Dear Colonel Walker:

1. R. Blake Reeves, Chairman of the Sierra Club-Niagara Group, asked me to reply to your letter regarding the Draft Environmental Impact Statement on the proposed project for Flood Control in the Tonawanda Creek Watershed.

2. Sierra Club-Niagara Group would like to reserve the right to comment and we intend to do so. Thank you for keeping us informed.

Yours truly

Antonia Dempster

Antonia Dempster
Sierra Club-Niagara Group

1. No response necessary.

2. The Corps will continue to coordinate proposed projects with the Sierra Club.

AD-A120 213 CORPS OF ENGINEERS BUFFALO NY BUFFALO DISTRICT F/G 13/2
TONAWANDA CREEK, GENESEE COUNTY, NEW YORK, REGIONAL FLOOD CONTR--ETC(U)
NOV 81

UNCLASSIFIED NL

2 OF 5
AD A
120213

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
REGION II
FEDERAL BUILDING
26 FEDERAL PLAZA
NEW YORK, NEW YORK 10007

OFFICE OF THE
REGIONAL DIRECTOR

June 8, 1976

Mr. Bernard C. Hughes
Department of the Army
Buffalo District, Corps
of Engineers
1776 Niagara Street
Buffalo, New York 14207

Dear Mr. Hughes:

Subject: EIS #020-05-76
Interim Report on Feasibility of Flood Management
Tonawanda Creek Watershed

1. On the basis of our review of the above we have determined that the impacts in those areas of concern to this Department have been adequately addressed.

2. We would however, suggest that since an expected result of this project will be increased development in areas previously designated as flood plain, efforts should be undertaken to initiate local/regional planning to assure that the growth patterns will be orderly.

We appreciate the opportunity to review your Draft EIS.

Sincerely yours,

Luther W. Stringham
Regional Environmental Officer

## CORPS RESPONSES TO THE U. S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
(Letter dated 8 June 1976)

1. No response necessary.

2. Those areas within the present 100-year floodplains must be regulated in accordance with the National Flood Insurance Program. Until the Batavia Reservoir Compound is constructed, the status of these lands, under the program, cannot be changed. Development must comply with requirements of the program.

All communities having lands which would be protected from the 100-year flood by the Batavia Reservoir Compound have plans for use of these lands. Although these communities would probably change their plans for lands to be protected, it is not expected that they would do so until design and construction of the Batavia Reservoir Compound is certain. This would not be the case for at least several years.

ROBERT V. MAERTEN
DEPUTY SUPERVISOR
TOWN OF PENDLETON

6570 CAMPBELL BLVD. LOCKPORT, NEW YORK 14094

June 17, 1976

Department of the Army
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Attention: Mr. Bernard C. Hughes
Colonel, Corps of Engineers

Gentlemen:

In re: Tonawanda Creek Watershed

1. In reply to your letter of May 24, 1976, please be advised that I am in favor of the construction of the Batavia Reservoir Compound.

2. I am extremely pleased that something is being done to alleviate regional flooding problems in the Tonawanda Creek Watershed and to prevent the possibility of any flooding in our Town.

Very truly yours,

Robert V. Maerten

Robert V. Maerten
Deputy Supervisor

f/

CORPS RESPONSES TO THE TOWN OF PENDLETON
(Letter dated 17 June 1976)

1. No response necessary.

2. The Corps will continue to maintain coordination of the proposed project with the town of Pendleton.

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Post Office and Courthouse Building
BOSTON, MASSACHUSETTS 02109

ER-76/456

JUN 17 1976

Colonel Bernard C. Hughes, District Engineer
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Dear Colonel Hughes:

1. *The following comments are provided in response to your letter of May 4, 1976, to Mr. John W. Larson requesting comments on the draft environmental statement for the proposed Flood Control project in the Tonawanda Creek Watershed, New York. Since this document will provide a basis for future congressional action, the Department will be asked to review and comment at a later date by the Chief of Engineers. Our comments are provided as field level review and are not the comments of the Department of the Interior.*

2. *The U. S. Fish and Wildlife Service reviewed the proposed project and provided a report to the District Engineer, Buffalo District, on January 28, 1976, recommending the Batavia Reservoir Compound as being the least environmentally damaging alternative. We appreciate the Corps of Engineers' selection of this alternative and find that, in general, the draft environmental statement adequately describes the proposed project's impacts on fish and wildlife resources. The following specific comments on the statement are offered for your consideration.*

3. *Paragraphs 1.03-1.04 state that the upper and lower reservoirs of the Batavia Reservoir Compound will involve the removal and purchase of eight residences. These residences are possibly located within the headwater fringe of the upper reservoir flood pool. However, in Section 4, Paragraph 4.02, it is stated that about 32 residences and*

CORPS RESPONSES TO THE USDI - FISH AND WILDLIFE SERVICE
(Letter dated 17 June 1976)

1. No response necessary.

2. No response necessary.

3. As the project has been changed slightly since the DEIS was circulated, all references to required relocations of residences have been changed in this FEIS. The project now requires relocation of 45 residences and four farms and businesses. The costs of relocations have been included in Table C1 of Appendix C. The entire cost of the project is a Federal responsibility.

*farmsteads within the limits of the maximum probable flood pools of the Batavia Reservoir Compound would be relocated. The disparity between the number of residences being relocated should be clarified. Also, there should be further clarification as to who is responsible for the purchase and relocation costs of the residences. If the federal government is responsible, this should be stated and the costs should be presented in your economic data in Appendix C.*

4. *Paragraphs 2.28-2.29 state that cursory on-site field observations of vegetation in the vicinity of the Batavia Reservoir Compound were made during October 28-29, 1975. Further detailed field observations are necessary, particulary in determining the types of vegetation present in areas of the proposed dikes, including the short-height dikes, where existing vegetation removal will occur. This section should also address any effect the proposed project's construction and location of dikes will have on the Christmas Fern (Aspidium acrostichoides), a native plant protected pursuant to Section 9-1503 of the Environmental Conservation Law, listed in Table 2H. Further, it would be beneficial if a map was included showing the location, extent, and importance of the wetland areas found within the Batavia Reservoir Compound site.*

5. *Paragraphs 2.31-2.33 discuss fish samplings taken at various stations along Tonawanda Creek. Except for the early winter fish survey conducted by Corps ecologists on December 4, 1975 when much of the creek was inaccessible, all other fish samplings were taken at areas outside the Batavia Reservoir Compound site. In order to determine the possible effects of the proposed project on the area's fishery, further fish survey work should be conducted on Tonawanda Creek in the proposed Batavia Reservoir Compound site.*

6. *Paragraph 2.34 states that bird species presented in Table 2K were the result of observations made on an October 28-29, 1975 field reconnaissance survey. Further surveys conducted during spring and early summer would be beneficial since bird migration on the Niagara Frontier reaches its peak at this time.*

7. *Paragraph 2.37 mentions that there are a number of significant wetland areas within the Batavia Reservoir Compound site. As presented in our discussion on Paragraphs 2.28-2.29 a map showing*

CORPS RESPONSES TO THE USDI - FISH AND WILDLIFE SERVICE (Cont'd)
(Letter dated 17 June 1976)

4. These paragraphs have now been placed in Appendix E of this FEIS. In response to the need for additional biological field data, the Buffalo District and the Cortland Field Office of the U. S. Fish and Wildlife Service conducted joint field studies of the area during the spring and summer of 1979. The results of these studies are presented in Appendix A of this FEIS.

5. Refer to Response 4 above. Additional field studies on the fisheries of Tonawanda Creek within the proposed project area were conducted during 1979. A report discussing the results of these fishery studies in included in Appendix A.

6. Additional data has been provided in Appendix A of this FEIS.

7. A wetland location map (Source: 1950 USGS Batavia South, NY, Quadrangle, series V821) has been provided in Appendix G of this Environmental Statement.

*the location of these wetland areas would be very helpful.*

8. *Paragraph 2.47 uses the 1973 edition of "Threatened Wildlife of the United States," published by the Fish and Wildlife Service, U. S. Department of the Interior as a reference source. This publication is no longer considered an official list, since it is neither accurate nor current. The present U. S. Department of the Interior, Fish and Wildlife Service official list of "Endangered and Threatened Wildlife and Plants" was published in the Friday, September 26, 1975, Federal Register. It includes the reclassification of the American Alligator and other amendments. Please find a copy attached.*

9. *Paragraph 4.20 states that wetlands in the lower reservoir would be subject to less frequent flooding with implementation of the proposed project. This paragraph should discuss in more detail the location and significance of these wetlands, particularly concerning the effects less frequent flooding will have on nesting and breeding areas of waterfowl and avian species, as well as pheasant wintering areas within the lower reservoir compound.*

10. *Paragraph 4.21 states that the construction of dikes for the proposed project would involve the filling of approximately eight acres of wetland in the existing floodplain. Does the eight-acre loss of wetlands include any further possible loss that may occur from access roads for movement of materials or equipment? Again, the significance of a loss of eight acres of wetland on the winter cover and nesting habitat for wildlife within the Batavia Reservoir Compound should be addressed in greater detail.*

11. *Paragraph 4.24 states that the proposed construction of dikes and the emergency spillway would require stripping about 73 acres. This paragraph should identify whether the stripping of 73 acres includes any possible vegetation removal resulting from access roads for movement of materials or equipment.*

12. *Paragraph 4.25 discusses the removal of debris jams and snags from Tonawanda Creek within the Batavia Reservoir Compound. This paragraph should address the probability and extent of removal of bank side vegetation during debris and snag removal. Every effort should be made to preserve vegetation along the banks of Tonawanda Creek within the project area, since removal will reduce shaded stream sections, resulting in increased water temperatures.*

8. The most recent list of endangered species has been consulted and new information on endangered species has been provided in Chapter 2 of this FEIS.

9. A location map of wetlands in the proposed project locale has been provided in Appendix G; also, paragraph 4.20 has been expanded in response to the comment.

10. The present approximate estimate of wetland acreage impacted, which is 3.5 acres for the modified Batavia Reservoir Compound, includes those lands on which dikes and dams would be proposed for construction. At this stage of planning in the engineering feasibility study, specific locations of access roads have not been determined. It is reasonable to assume that some further temporary disturbance or loss of land might occur from access roads. Most likely, such access road locations would be over terrestrial land rather than through wetlands. If this proposed project is authorized and funded for detailed design, avoidance of existing wetland areas for access roads would be assured. Additional data on winter cover and resting habitat has been provided in Appendix a of this FEIS. Paragraph 4.21 in this environmental statement has been expanded in response to the comment.

11. Paragraph 4.24 has been expanded in response to the comment. Since the sizes and locations of access roads have not been specifically defined in this phase of the Corps planning effort for the proposed project, the stripping estimate, now 38 acres for the modified project, does not include allowance for access roads. The acreage estimate would be updated during advanced engineering design, if and when the project is authorized by Congress.

12. Access to debris jams and snags by construction equipment would unavoidably destroy some natural vegetation along the creek banks. Extent of debris and snag removal has not been specifically determined yet. As suggested by the U. S. Fish and Wildlife Service, every effort will be made to preserve bank vegetation along Tonawanda Creek in the project area. Site specific removal of debris and snags in the creek would probably be done by use of heavy equipment on one side of the bank, where possible. Consideration would be given to planting disturbed bank areas with herbaceous and woody vegetation to help mitigate some of the plant loss caused by construction.

13. We appreciate the opportunity to review the draft environmental statement at this time, and look forward to further coordination on the proposed project.

Sincerely yours,

ACTING Regional Director

Attachment

CORPS RESPONSES TO THE U.S.D.I. - FISH AND WILDLIFE SERVICES (Cont'd)
(Letter dated 17 June 1976)

13. The Corps will continue to maintain close environmental coordination with the U. S. Fish and Wildlife Service on the proposed Batavia Reservoir Compound project.

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
NORTHEASTERN AREA, STATE AND PRIVATE FORESTRY
6816 MARKET STREET, UPPER DARBY, PA 19082
215-596-1672

8400
June 18, 1976

LTC Byron G. Walker
Deputy District Engineer
Department of the Army
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Refer to: NCBED-PE, Draft Environmental Statement
Tonawanda Creek Watershed
NY

Dear Col. Walker:

1. Of the four plans described in the above Statement, we consider the selected plan -- Batavia Reservoir -- the most environmentally sound. We understand that flood water inundation will not continue beyond a period that would cause damage to elm, ash, and cottonwood.

2. Loss of habitat and wetland appears unavoidable and to be the minimum compatible with completion of the project.

3. If possible, at dike and spillway construction areas (p. 153) seeding and mulching should be supplemented by planting trees and shrubs to restore wildlife habitat.

Sincerely,

DALE O. VANDENBURG
Staff Director
Environmental Quality
Evaluation

CORPS RESPONSES TO THE U.S.D.A. - FOREST SERVICE
(Letter dated 18 June 1976)

1. No comment necessary.

2. The Corps concurs that some loss of habitat would be unavoidable during project construction as one of the trade-off impacts to provide flood management protection. Disturbed soils would be receeded with a herbaceous vegetation mixture to provide cover protection against soil loss into downstream areas. Although reseeded areas would *not contain* the variety of natural woody and herbaceous plant species that were established prior to project construction, the herbaceous plantings would somewhat help to mitigate habitat that was disrupted by construction.

3. Although supplemental plantings of trees and shrubs would provide more variety and help restore wildlife habitat to some degree, in addition to enhancing the natural appearance of the proposed project, such woody plantings would not be practical from an engineering standpoint. During periods of flooding, trees and shrubs would tend to act as snags that could trap drift materials coming downstream and obstruct flow that would contribute to overbank flooding. Root system development and snagged debris along dikes could endanger the structural stability of the project. Tree and shrub roots could cause dike seepage pathways to develop, or high winds could upheave entire root systems and weaken earth dikes and dams. The emergency spillway would also require unobstructed flow in the event of a significant flood.

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

700 East Water Street, Syracuse, New York 13210

June 22, 1976

LTC Byron G. Walker
Deputy District Engineer
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Dear Col. Walker:

We have reviewed the Draft Environmental Impact Statement for the Final Feasibility Report on Flood Management in the Tonawanda Creek Watershed prepared by the Buffalo District, Corps of Engineers, dated April 1976.

Our comments are listed below:

1. Page 75 and 76 - Table 2.M

   This table could be improved by including the units of BOD, DO, $PO_4$, etc. at head of each column.

2. Page 80 - Plate 2.12

   Units are not shown.

3. Page 91 - Plate 2.17

   Has the LEGEND been inadvertently rotated 90° on the map?

4. Page 138 and 139 - Table 2.FF

   The exact same table appears to be duplicated on each page!

5. Page 151 - Paragraph 4.16

   The first sentence states, "If the Batavia Reservoir Compound were constructed, farmland use within this site would remain essentially the same." It is possible that use might remain the same but very likely, it will not. It is recognized that the lower reservoir area will receive a 10-year protection but the upper

## CORPS RESPONSES TO THE USDA - SOIL CONSERVION SERVICE
(Letter dated 22 June 1976)

1. Instead of placing the units at the head of each column in the table as suggested in the comment, the parameter units have been included in a footnote at the bottom of the table. This table and the plates and tables cited in the next three comments have been placed in Appendix E of this FEIS.

2. The unit mg/l has been added to Plate 2.12 in response to the comment.

3. The legend on Plate 2.17 has been corrected in response to the comment.

4. Duplicated Table 2.FF has been removed from page 139 in response to the comment.

5. The Corps concurs that the upper dry-retention reservoir of the Compound would be flooded more frequently that would in turn have an adverse impact on the intensity of agriculture. This would be an unavoidable trade-off that would make cultivation of farmlands in the upper reservoir impractical.

reservoir area will flood much more frequently. In this area, at least, intensity of agricultural use will be decreased significantly.

6. Page A-1 - Glossary of Terms

BIOCHEMICAL OXYGEN DEMAND (BOD) - Is it proper to assume this is a 5-day BOD? The definition should clarify this point.

We appreciate the opportunity to review and comment on this proposal.

Sincerely yours,

Robert L. Hilliard

Robert L. Hilliard
State Conservationist

cc: R. M. Davis, Administrator, SCS, Washington, D. C.
Dr. Fowden G. Maxwell, Coordinator, Office of Environmental Quality Activities, Office of the Sec'y, USDA, Washington, D. C.
Council on Environmental Quality, Washington, D. C., Attention: General Counsel (5 copies)

6. The intent of the BOD definition in the Glossary of Terms on page A-1 was to define in basic terms what Biochemical Oxygen Demand would mean to a reader. Telephone communication on 7 July 1976 with a representative of the Erie County Laboratory Public Health Division in Buffalo, NY, clarified the fact that a 5-day BOD test was used in their stream study. The glossary of terms has been placed in Appendix I of this FEIS.

# United States Department of the Interior

NATIONAL PARK SERVICE

*NORTH ATLANTIC REGION*
150 CAUSEWAY STREET
BOSTON, MA. 02114

IN REPLY REFER TO:
L-7619-NAR-(PE)
ER-76/456

June 22, 1976

CORPS RESPONSES TO THE USDI - NATIONAL PARK SERVICE
(Letter dated 22 June 1976)

Colonel Bernard C. Hughes
District Engineer
88 Department of the Army
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Dear Colonel Hughes:

1. This will serve as a multiple response to your request for review and comment of:

4 May on - Draft Environmental Statement, Proposed Flood Control, Tonawanda Creek Watershed, Erie, Genesee, Niagara, and Wyoming Counties, New York (originally sent to our Departmental Office of Environmental Project Review which advised our direct response to you).

24 May on - Draft Feasibility Report for Tonawanda Creek Watershed New York.

3 June on - Reconnaissance Level Literature Search and Records Review (cultural resources report-largely on archeological values) for Tonawanda Creek Watershed, New York. This report was prepared for the Corps by Barbour and Miller of Department of Anthropology, SUNY at Buffalo.

2. You should understand that our comments on the cultural resources report and the draft feasibility report are provided as technical assistance based solely on the interests, expertise and responsibilities of the National Park Service. The comments on the draft environmental statement are also those of the National Park Service as a portion of the collective expertise of the Department, but a consolidated Departmental commentary will be presented at a later date upon the Chief of Engineer's request to review the proposal.

1. No response necessary.

2. No response necessary.

3. Cultural Resources Report. Because the findings of this report are basic to the development of an adequate environmental impact statement, we will speak to it first. The report appears adequate as a literature search and records review, and we note that many archeological and potential historical sites were identified. It is also noted that the State Historic Preservation Officer's office contributed a listing of sites on and recommended for listing on the National Register of Historic Places, as well as archeological sites on file with that office.

4. Draft Environmental Statement. Section 2, paragraphs 2.104 and 2.105 (pages 131-134) makes appropriate use of the information recorded in the cultural resources report. Appendix F-1, summary of that cultural resources report further emphasized the potential and probability of archeological resources in the overall study area. That summary reflects on the project alternative which would cause less effect on such resources and indicates that some alternatives would require much more detailed archeological investigations prior to final project design. Paragraph 2.104 indicates that consultation of the National Register of Historic Places has been accomplished. Up to this point, consideration for the protection of cultural resources would appear satisfactory. However, as this is where the consideration stops, we feel that necessary required considerations are incomplete.

5. We find this environmental statement deficient as now presented for failure to discuss accomplished or intended efforts to fulfill the requirements of EO 11593 and follow the procedures for compliance with Section 106 of the Historic Preservation Act as presented in 36 CFR Part 800. While it may be the intent to perform such compliance at a later project phase, the level of detail in discussing various alternatives in this draft environmental statement warrants a commensurate consideration for the protection of cultural resources so that the selection of the best alternative can be properly guided.

6. With the citation of all the National Register sites involved, certainly the alternative project selected is very likely to undergo Section 106 proceedings. Further, until the many archeological sites identified have been evaluated for their significance and eligibility for inclusion on the National Register of Historic Places, compliance with Section 106 requirements remains a potential threat to the accomplishment of the selected project alternative.

7. Section 4, paragraph 4.11.1 (page 150) flatly states that "some cultural resources will be lost" with the mollification that preservation efforts will be considered in the public recreation development areas.

8. Paragraph 4.27 (page 154) expresses a partial approach to the protection of cultural resources. However, it would seem essential, even as an aspect of mitigation of harmful effects, to first determine where the cultural resources are that require protective measures.

CORPS RESPONSES TO THE USDI - NATIONAL PARK SERVICE (Cont'd)
(Letter dated 22 June 1976)

3. No response necessary.

4. In order to more fully address the project impacts on cultural resources a reconnaissance level survey was undertaken. This survey identified 21 cultural resources sites. This report is currently under review by the NYSHPO and HCRS-IAS - Atlanta. Further actions are pending completion of this review.

5. In response to your statements a new cultural resources report has been prepared and revisions made in this FEIS.

6. See Response No. 4.

7. This paragraph has been deleted in the FEIS. Preservation efforts will be undertaken for any sites that are identified and impacted on by the project.

8. See Response No. 4.

9. We would remind you that the Director, Office of Archeology and Historic Preservation, National Park Service, Washington, D. C. 20240, will, upon request, provide a determination of eligibility of sites of historical or archeological significance for inclusion in the National Register of Historic Places.

10. Paragraph 9.04 (page 186) mentions initial coordination with the National Park Service as further identified in our technical assistance letter of January 5 displayed as Appendix B-1-2.

11. It is <u>not</u> our outlook that detailed archeological investigations should be performed over the <u>entire</u> study area. However, we are concerned that adequate considerations be given at this time for the protection of cultural resources commensurate with the detail of consideration given all other aspects leading to the selection of a project alternative. Certainly, the applicability and necessity for compliance with Section 106 should be discussed which beckons completion of EO 11593 requirements and applicable NEPA provisions already initiated. It would seem possible that the unfinished cultural resource protection consideration work can be satisfactorily completed before finalization of this environmental statement and that the present inadequacies in the treatment of this bona fide aspect of the human environment can be rectified in the final environmental statement.

12. <u>Draft Feasibility Report</u>. As indicated in our letter of January 5 included in Appendix F, we were pleased to note cultural resources coverage in the Preliminary Feasibility Report and fully expected to see an adequate treatment of cultural resource protection considerations in the following stages of the report. We are now concerned that <u>all</u> cultural resource considerations seem to have been <u>dropped</u> from the feasibility report, particularly when numerous other aspects and criteria, such as biological, climatological, land use, economical, recreational resources, along with population growth, transportation trends, housing needs and industrial activity factors are maintained and treated in significant detail in the main report and technical appendices. In a manner commensurate to the treatment of the many other factors mentioned above, we recommend that cultural resource protection considerations be included in the final report and that all efforts to comply with standing requirements for the protection of cultural resources should be clearly presented.

13. Again, in summary, it is not our intent to demand an excessive effort to survey, investigate and evaluate the impacts of every alternative.

CORPS RESPONSES TO THE USDI - NATIONAL PARK SERVICE (Cont'd)
(Letter dated 22 June 1976)

9. Neither the project or the cultural resources portion of the project has reached a stage where this is appropriate. Upon completion of the review of the Reconnaissance Survey Report decisions will be made, in conciliation with the SHPO as to further requirements. At this time it is envisioned that an archaeological testing program will be necessary prior to submittal of a request for determination of eligibility to the NRHP.

10. No comment necessary.

11. See comment after the report is fully coordinated. The information will be included in the FEIS or issued as supplement information at a latter date if inclusion is not possible.

12. Responses to cultural resource coverage in the Draft Feasibility Report are given in that report and therefore, are not addressed in this environmental statement.

13. No response necessary.

CORPS RESPONSES TO USDI - NATIONAL PARK SERVICE (Cont'd)
(Letter dated 22 June 1976)

14. Moreover, it is our purpose to technically assist the Corps in its responsibility to protect cultural resource values from adverse effects that may or will result from any selected project alternative.

Sincerely yours,

Gilbert W. Calhoun

Gilbert W. Calhoun
Acting Regional Director

14. No response necessary.

UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Science and Technology
Washington, D.C. 20230

June 22, 1976

Colonel Bernard C. Hughes
Buffalo District, Corps of Engineers
Department of the Army
1776 Niagara Street
Buffalo, New York 14207

Dear Colonel Hughes:

1. This is in reference to your draft environmental impact statement entitled " General Investigation, Tonawanda Creek Watershed, New York." The enclosed comments from the National Oceanic and Atmospheric Administration are forwarded for your consideration.

2. Thank you for giving us an opportunity to provide these comments, which we hope will be of assistance to you. We would appreciate receiving eight copies of the final statement.

Sincerely,

Sidney R. Galler

Sidney R. Galler
Deputy Assistant Secretary
for Environmental Affairs

Enclosures Memos from: Mr. Eugene J. Aubert
Director, GLERL, RF24

Dr. Gordon Lill
Deputy Director, NOS

CORPS RESPONSES TO THE U. S. DEPARTMENT OF COMMERCE - THE ASSISTANT SECRETARY FOR SCIENCE AND TECHNOLOGY
(Letter dated 22 June 1976)

1. No response necessary.

2. Eight copies of the Final Environmental Statement will be sent to the Department of Commerce when the document is completed.

Gordon

**U.S. DEPARTMENT OF COMMERCE**
**National Oceanic and Atmospheric Administration**
ENVIRONMENTAL RESEARCH LABORATORIES
Great Lakes Environmental Research Laboratory
2300 Washtenaw Avenue
Ann Arbor, Michigan 48104

May 28, 1976

JUN 2 1976

TO : Director
Office of Ecology and Environmental Conservation, EE

FROM : Eugene J. Aubert
Director, GLERL, RF24

SUBJECT: DEIS 7605.15 - Interim Report on Feasibility of Flood Management in Tonawanda Creek Watershed

1. The subject DEIS prepared by the Corps of Engineers, Buffalo District, on environmental effects of proposed flood management in Tonawanda Creek watershed has been reviewed and comments herewith submitted.

2. During the four to five years of construction of Batavia Reservoir Compound and clearing of Tonawanda Creek, fine soil particles will be suspended and carried downstream. They will be deposited in slack water of either New York State Barge Canal or Tonawanda Harbor, or through the Niagara River in Lake Ontario. It will cause some deterioration of water quality and silting in these waterways. After project completion, however, some improvement of quality of flood water can be expected due to reduction of peak flows.

CORPS RESPONSES TO THE U. S. DEPARTMENT OF COMMERCE - NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION - ENVIRONMENTAL RESEARCH LABORATORIES
(Letter dated 2 June 1976)

1. No response necessary.

2. The Corps concurs that during construction of the Batavia Reservoir Compound, temporary stream siltation into downstream areas would be unavoidable. The Contractor would be required to mitigate soil loss into the creek by seeding the mulching disturbed bank soils as soon as possible.

U.S. DEPARTMENT OF COMMERCE
**National Oceanic and Atmospheric Administration**
NATIONAL OCEAN SURVEY
Rockville, Md. 20852

C52/JLR

JUN 11 1976

JUN 10 1976

TO: Dr. William Aron
Director
Office of Ecology and Environmental Conservation

FROM: Dr. Gordon Lill
Gordon Lill
Deputy Director
National Ocean Survey

SUBJECT: DEIS #7605.15 - Interim Report on Feasibility of Flood Management in Tonawanda Creek Watershed

1. The subject statement has been reviewed within the areas of NOS responsibility and expertise, and in terms of the impact of the proposed action on NOS activities and projects.

The following comment is offered for your consideration.

2. Geodetic control survey monuments may be located within the proposed project areas. If there is any planned activity which will disturb or destroy these monuments, NOS requires not less than 90 days notification in advance of such activity in order to plan for their relocation. NOS recommends that funding for this project includes the cost of any relocation required for NOS monuments.

CORPS RESPONSES TO THE U. S. DEPARTMENT OF COMMERCE - NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION - NATIONAL OCEAN SURVEY
(Letter dated 11 June 1976)

1. No response necessary.

2. Construction of the proposed project would be at least five years away, if it is authorized and funded by Congress. During our preconstruction planning stage, the Corps would contact the National Oceanic and Atmospheric Administration to coordinate removal of any monuments that may be within the construction area, if any exist in the Batavia Reservoir Compound locale.

**New York State Department of Environmental Conservation**
5 Road, Albany, New York 12233

Peter A. A. Berle, Commissioner

June 24, 1976

LTC. Byron G. Walker
Deputy District Engineer
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Dear Colonel Walker:

Draft Environmental Impact Statement
Tonawanda Creek Watershed, N. Y.
DEC Project No. 089-007

We have reviewed the above noted document and have enclosed our comments.

1. In summary, the statement is generally accurate, but effects of siltation in the reservoirs should be addressed in the Final E.I.S. In addition, the enhancement of other wetlands in the project area to compensate for the probable impacts on wetlands in the lower detention reservoir should be considered. We believe that adverse environmental effects can be minimized by incorporating adequate measures during construction to control soil erosion, sedimentation, and stream pollution. Finally, the feasibility of employing non-structural measures in the lower basin in conjunction with the selected plan should be addressed.

2. Thank you for the opportunity to review this statement. We would like to receive five copies of the Final E.I.S. when it is available.

Very truly yours,

Terence P. Curran
Director of Environmental Analysis

Enclosure

CORPS RESPONSES TO THE NYS DEPARTMENT OF ENVIRONMENTAL CONSERVATION
(Letter dated 24 June 1976)

1. Corps responses to the summarized comments in this paragraph from the New York State Department of Environmental Conservation, letter dated 24 June 1976, are provided on the following two pages.

2. Five copies of the Final Environmental Statement will be sent to the NYS Department of Environmental Conservation when the document has been completed.

**COMMENTS ON DRAFT ENVIRONMENTAL IMPACT STATEMENT**
**TONAWANDA CREEK WATERSHED**

3. Section 1.08 - Disposal of solid wastes generated by construction of the project must be at a site approved by the Department of Environmental Conservation. The Department's Regional Solid Waste Engineer at Avon should be contacted regarding specific requirements.

4. Section 4 - The statement should discuss effects of siltation in the reservoirs. The impoundment of Tonawanda Creek floodwaters, which carry a high silt load, will probably result in the deposition of silt within the reservoir areas. Some wetlands in the detention reservoirs may be detrimentally altered by the deposition of this silt load. In addition, erosion of silt after the reservoirs are drained may result in the filling of wetlands, drainage ditches and small streams within the reservoirs. This silt deposition may also cause other environmental problems, such as obnoxious odors, which should be addressed.

5. Section 4.03 - Although soil erosion, stream turbidity and sedimentation are identified as temporary, long range adverse impacts may result. The smothering of aquatic organisms or destruction of their habitat, for even a short period, can still have a permanent effect. Once destroyed, aquatic life may require a considerable time to reestablish itself. Therefore, it is essential that measures be taken during construction to keep soil erosion and water pollution to an absolute minimum.

6. Section 4.20 - This section indicates that wetlands in the lower reservoir would be subject to less frequent flooding. However, some wetlands in this area may depend on annual flooding for water recharge purposes; annual flooding may even be essential to the existance of some of these wetlands.

7. In view of the actual and potential adverse impacts on the wetland habitat found in the detention reservoir areas, consideration should be given to creating or enhancing a wetland in the project area to mitigate this loss of habitat. A wetland area southwest of Batavia near the intersection of Route 63 and Shepard Road would be suitable for enhancement.

8. Section 4.28 - Plans to relocate Peaviner Road should include measures to minimize soil erosion, sedimentation and stream pollution.

9. Section 6.07 - Since the Batavia Reservoir Compound plan would provide only 50-year flood protection in the lower Tonawanda Creek Basin (the Huron Plain Floodland), consideration should be given to incorporating non-structural measures in conjunction with the Batavia Reservoir Compound proposal.



**CORPS RESPONSES TO THE NYS DEPARTMENT OF ENVIRONMENTAL CONSERVATION (Cont'd)**
**(Letter dated 24 June 1976)**

3. The Corps will coordinate with the NYS Department of Environmental Conservation with regard to site selection approval, and the Regional Solid Waste Engineer at the Department's office in Avon would be contacted regarding specific requirements, as recommended.

4. If the proposed project were implemented, some deposition of silt onto wetlands by temporary containment of floodwaters in the Batavia Reservoir Compound would occur. But under natural conditions, floodwater deposits silt onto wetlands and drainageways in these areas. The area of more silt accumulation would probably occur near the dam of the upper reservoir. It is reasonable to assume that silt would accumulate on some wetlands in this area and would destroy some vegetation and possibly fill in some low areas. Generally, this would be followed by reestablishment of terrestrial or aquatic vegetation. Wetlands within the lower reservoir would be less subject to silt accumulation because of operation of the upper reservoir. The proposed project would provide various degrees of protection from siltation due to flooding on wetlands located in the floodlands downstream of the Batavia Reservoir Compound. With regard to the possibility of obnoxious odors from silt deposits, such temporary odors may occur after flooding, but wind and reestablishment of plant growth would tend to reduce this potential impact in the rural location of the project. Present land use in the area which includes use by dairy cattle and fertilization of agricultural land with commercial fertilizers and manure, contributes to occasional odor which cannot be avoided in necessary farming operations to keep soils productive.

5. Measures will be taken to mitigate soil erosion, stream turbidity, and sedimentation as much as possible. Consideration would be given to installation of temporary settling basins and interceptor ditches to contain runoff from soils disturbed by construction. Replanting of vegetation and mulching of seeded areas would also be done to conserve soils on disturbed terrain. The Contractor will also be required to minimize temporary environmental impacts which includes noise, dust, and water turbidity, in accordance with the procedures and regulations outlined in the Civil Works Construction Guide Specification for Environmental Protection (CW 01430, 1979). Mitigation measures are further described in paragraph 4.32 of this Environmental Statement.

6. As indicated on the Batavia South, NY, U. S. Geological Survey Quadrangle Map (1950), wetlands in the Batavia Reservoir Compound are fed by local small tributaries. Floodwaters from Tonawanda Creek are not the main source of recharge for wetlands in this area.

7. Most wetlands are found in the lower reservoir. These wetlands would be enhanced to some degree by the reduction in siltation that would be afforded to them by the upper reservoir. If Congress approves and funds the Phase I General Design Memorandum, consideration will be given to feasibility of enhancing wetland in the project area through further coordination with the New York State Department of Environmental Conservaiton.

CORPS RESPONSE TO THE NYS DEPARTMENT OF ENVIRONMENTAL CONSERVATION (Cont'd)
(Letter dated 24 June 1976)

8. The Corps concurs. Measures to minimize soil erosion, sedimentation, and stream pollution are outlined in a previous Corps response (paragraph 5) and would be part of the Contractor's requirements for construction.

9. Consideration was given to incorporation of nonstructural measures in conjunction with the Batavia Reservoir Compound proposal, however, at this point in time, Federal - non-Federal cost sharing responsibilities are indeterminate. Implementation of the Batavia Reservoir Compound would not preclude consideration of nonstructural measures during General Design Memorandum I study. The Corps has provided flood plain information reports to the towns of Tonawanda, Amherst, and Clarence and would work with these communities upon request to implement nonstructural measures such as flood plain management.

United States Department of the Interior
BUREAU OF OUTDOOR RECREATION
NORTHEAST REGIONAL OFFICE
Federal Building - Room 9310
600 ARCH STREET
Philadelphia, Pennsylvania 19106

IN REPLY REFER TO:
ER-76/456

JUN 25 1976

Colonel Bernard C. Hughes
District Engineer
Buffalo District
Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Dear Colonel Hughes:

We have reviewed the draft environmental statement for Flood Control in the Tonawanda Creek Watershed; Erie, Genesee, Niagara, and Wyoming Counties, New York.

1. We commend the District on the consideration and the recommendation of "dry bed" reservoirs to reduce flood damage in the Tonawanda Creek watershed. Dry bed reservoirs have great recreation potential such as for the canoe trail described in the subject statement. However, we suggest that consideration also be given to the purchase of a strip along the entire watercourse within the project limits so that, eventually, walking trails and picnic areas could be developed. Public management of a narrow strip along the creek would assure good public access to the canoe trail and other activities.

2. We suggest consideration of a special design for the energy dissipation basins below both of the normal flow outlet works so that the basins may be eventually developed into outdoor swimming facilities by local or state recreation agencies. We note only 3 public swimming facilities in your inventory.

3. The statement would be improved by the inclusion of a map showing the sites of existing recreational facilities, especially those which are likely to be impacted during flood conditions.

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

CORPS RESPONSES TO THE USDI - BUREAU OF OUTDOOR RECREATION
(Letter dated 25 June 1976)

1. A recreation trail along Tonawanda Creek is currently under consideration by the Genesee County Planning Department.

2. During the Phase I General Design Memorandum, consideration will be given to designing the energy dissipation basins of the principal outlet works, so that the basins might be developed into outdoor swimming facilities by local or State agencies.

3. A recreation map showing the general locale of the Batavia Cooperative Hunting Area has been included in Appendix H of this statement in response to the comment.

4. The location of the Genesee County Park in the Town of Betheny should be noted and the park should be included in your inventory.

5. I hope that these remarks will be helpful in the development of the final statement.

Sincerely yours,

DEPUTY Regional Director

CORPS RESPONSES TO THE U.S.D.I. - BUREAU OF OUTDOOR RECREATION (Cont'd)
(Letter dated 25 June 1976)

4. A location map of the Genesee County Park in the town of Bethany has been inclosed in Appendix H of this environmental statement; also, it has been included in the inventory on page 124 in Section 2.

5. The Corps appreciates comments received from the Bureau of Outdoor Recreation, and will continue to coordinate proposed projects with the Bureau.

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**

REGION II
26 FEDERAL PLAZA
NEW YORK, NEW YORK 10007

Class. LO-2

JUN 25 1976

Colonel Bernard C. Hughes
District Engineer
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Dear Colonel Hughes:

We have reviewed the draft environmental impact statement (EIS) for Flood Control in the Tonawanda Creek Watershed, New York. The following comments are offered for your consideration in preparing the final EIS.

1. The destructive effect of overbank flooding is mentioned throughout the draft EIS. This destruction takes place when stream banks become saturated and collapse as floodwaters recede faster than the banks can drain. Once farmlands are saturated, drainage is very slow and cultivation is impeded. We believe that construction of the proposed dams will not improve these conditions. In fact, conditions may worsen in the upper reservoir area. The final EIS should, therefore, describe the measures that will be taken to control erosion and improve drainage after project implementation.

2. Land currently used for farming could still be used for such a purpose. However, the threat and extent of flooding in the upper dry-retention reservoir would be more severe than at present. The final EIS should indicate if the farmers plan to cultivate their lands after project implementation. If they do, would their losses due to a disastrous flood during the growing season be compensated?

3. In our letter dated January 28, 1976 on the preliminary feasibility report for this project, we expressed preference for the Alabama Reservoir Compound alternative since the area that would be affected by this alternative is located in an already diked wildlife preserve. However, after reviewing the draft EIS and in light of comments by the New York State Department of Environmental Conservation and the U.S. Fish and Wildlife Service indicating potentially severe impacts to the preserve if the Alabama Reservoir Compound alternative is chosen, we now believe that the Batavia Reservoir Complex, as proposed, would be the lesser environmentally damaging alternative for flood control.



CORPS RESPONSES TO THE U. S. ENVIRONMENTAL
PROTECTION AGENCY - REGION II
(Letter dated 25 June 1976)

1. The Corps concurs that some destructive effects of flooding occurs when streambanks become saturated and collapse as floodwaters recede faster than banks can drain; that slow soil drainage from saturated farmlands would impede cultivation, and that implementation of the proposed project would probably not improve these conditions significantly in the upper reservoir area. However, flooding of farmlands even within the upper reservoir would occur less frequently with the project. This is so because part of the proposed project is to clear and snag the channel of Tonawanda Creek through the B.R.C. to improve its capacity. This would improve drainage and lessen the frequency of flooding. Because the frequency of flooding would be less, the frequency of channel banks and adjacent farmland saturation should be lessened. This would serve erosion control and would improve farmlands for cultivation. Consideration by the Corps will be given to obtaining easements on lands within the lower reservoir, to enable the storing floodwater there when necessary.

2. Since the upper reservoir would be designed to provide about a 10-year degree protection to floodlands in the lower reservoir of the Compound, flooding would occur far less frequently on lands below the upper dam. In order to provide this protection, flooding of the upper reservoir would be necessary.

3. Based on Corps communication with the New York State Department of Environmental Conservation and U.S.D.I. Fish and Wildlife Service with regard to the Alabama Reservoir Compound, the Corps viewed the potential impacts that this flood management alternative could have on the State-owned Wildlife Management Area as severe enough to eliminate this alternative from further consideration, and concurs with the U. S. Environmental Protection Agency that the Batavia Reservoir Compound would be the lesser environmentally damaging alternative for flood management.

4. In accordance with EPA policy, this EIS has been classified LO-2, which indicates that EPA lacks objections to the proposed action and that the draft EIS does not contain certain information necessary to fully evaluate environmental impacts.

5. Two copies of the final EIS are requested for subsequent review. If you have any questions concerning our comments, please feel free to contact us at (212) 264-8556.

Sincerely yours,

Barbara M Metzger

Barbara M. Metzger
Chief
Environmental Impacts Branch

CORPS RESPONSES TO THE U. S. ENVIRONMENTAL PROTECTION AGENCY - REGION II (Cont'd)

4. Telephone communication on 7 July 1976 with the EIS Coordinator at the Region II EPA Environmental Impact Branch office, further clarified this comment in that, the "certain information necessary to fully evaluate environmental impacts" refers to the aforementioned comments in this comment letter from EPA dated 25 July 1976.

5. As requested, when completed, two copies of the Final Environmental Statement for this phase of the engineering planning study will be provided to the region II Environmental Protection Agency Office.

TONAWANDA CREEK, NY
REGIONAL FLOOD CONTROL

APPENDICES TO ACCOMPANY THE FINAL ENVIRONMENTAL IMPACT STATEMENT DATED DECEMBER, 1980

# APPENDIX A
# BIOLOGICAL STUDIES AND FISH AND WILDLIFE COORDINATION

## SECTION A-1
## FISH AND WILDLIFE SERVICE COORDINATION ACT REPORT

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
100 Grange Place
Room 202
Cortland, New York 13045

October 23, 1980

Colonel George P. Johnson
District Engineer, Buffalo District
U.S. Army Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Dear Colonel Johnson:

This constitutes our report on effects the flood control project for the Tonawanda Creek Watershed, Towns of Batavia and Alexander, Genesee County, New York, would have on fish and wildlife resources. It was prepared under the authority of and in accordance with Section 2(b) of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). This report supersedes our report of April 16, 1980.

Authorization to study the feasibility of flood management in the Tonawanda Creek Watershed, New York, derives from a resolution of the Senate Committee on Public Works, United States Congress, adopted June 15, 1950. This authorization was expanded by resolutions of the House of Representatives Committee on Public Works, United States Congress, adopted August 16, 1950 and July 23, 1956. Present authorization provides only for a determination of project feasibility, whereas additional feasibility studies (General Design Memorandum), as well as the actual construction, have yet to be authorized and funded by Congress.

Engineering and geophysical data presented in this report are from the Interim Report on Feasibility of Flood Management in Tonawanda Creek Watershed and Technical Appendices (U.S. Army Corps of Engineers, 1979) and from communications with your office prior to February 15, 1980. Biological data are primarily from field reconnaissance conducted by personnel from your office and from our office in Cortland, New York.

Data were also taken from unpublished Hunter Use and Game Survey Reports for the Batavia Cooperative Hunting Area, New York State Department of Environmental Conservation, Avon, New York and from unpublished fisheries surveys conducted in the Tonawanda Creek basin by the State University of New York at Buffalo and Bio Systems Research, Inc., Buffalo, New York. Baseline habitat conditions were evaluated by an interagency team comprised of personnel from your office, the U.S. Fish and Wildlife Service, and the New York State Department of Environmental Conservation using the Service's Habitat Evaluation Procedures. Our analysis is based on a 100-year project life for the years 1980 through 2079.

This report has been reviewed and endorsed by the Division of Fish and Wildlife of the New York State Department of Environmental Conservation as signified by the attached letters from Director Kenneth F. Wich, dated February 20 and September 29, 1980.

## DESCRIPTION OF THE PROJECT

The selected plan for flood management in the Tonawanda Creek Watershed is the Batavia Reservoir Compound (modified) (Fig. 1). The proposed plan is to construct two floodwater detention reservoirs (dry dams) on Tonawanda Creek for the primary purpose of reducing average annual flood damages in the lower basin by approximately 74 percent. At maximum floodpool, the reservoirs would inundate a tract of roughly 4,763 acres (1,929 ha) (about 894 acres (362 ha) in the upper reservoir and 3,869 acres (1,567 ha) in the lower reservoir) of bottomland between the Village of Alexander and the City of Batavia, Genesee County, New York.

The upper dam would be located approximately 200 feet (61 m) downstream of the Delaware Lackawanna Railroad (Conrail) embankment and would stretch 5,450 feet (1,661 m) across the Tonawanda Creek Valley (Fig. 1). The width by height dimensions of the dam would be 98 x 19 feet (30 x 5.8 m). This embankment would be designed to function as an emergency spillway with a top elevation of 922.5 feet (281.2 m). Approximately 2 feet (60 cm) of water would flow over the dam during a Standard Project Flood assuming a maximum pool elevation of 924.5 feet (281.8 m).

The principal outlet works for the upper reservoir would consist of a control structure, stilling basin, and outlet channel located at or near the intersection of the upper dam and Tonawanda Creek. The control structure would be a five-conduit reinforced concrete box culvert with the capacity to pass flows of 2,000 cfs (56 cms) under natural flow conditions and up to 10,700 cfs (300 cms) under the 100-year flood condition. Each conduit would be 11 feet wide by 11 feet high (3.4 x

3.4 m) and equipped with an electrically operable fixed wheel control gate. An upstream inlet flume would funnel water into the gated conduits. The inlet flume would consist of a reinforced concrete section located adjacent to the control gates and steel sheetpile wingwalls. The channel bottom between the wingwalls would be protected with 24-inch (60 cm) riprap placed on a 12-inch (30 cm) bedding layer. The riprap would extend from the concrete floor slab to a line 10 feet (3 m) upstream of the wingwalls. The stilling basin would be a reinforced concrete structure 61 feet (18.6 m) wide and 62 feet (18.9 m) long with a raised end sill 4 feet (1.2 m) high. A new outlet channel, starting at the stilling basin end sill, would be excavated normal to the dam and would extend downstream for approximately 1200 feet (366 m) to a junction with the existing creek channel. The outlet channel bottom, flaring from a width of 71 feet (21.6 m) at the stilling basin to 91 feet (27.7 m), would be protected with 24-inch (60 cm) riprap placed on a 12-inch (30 cm) bedding layer for a distance of approximately 100 feet (30.5 m). The meandering Tonawanda Creek channel immediately downstream from the upper dam would be abandoned.

The lower dam would be located approximately one-half mile (0.8 km) south of the City of Batavia and would stretch 5,600 feet (1,707 m) across the Tonawanda Creek valley (Fig. 1). The width by height dimensions of the dam would be 69 x 12 feet (21 x 3.7 m). This embankment is designed to function as an emergency spillway with a top elevation of 900 feet (274.3 m) from Creek Road westward for approximately 4,000 feet (1,219 m). Approximately 2.6 feet (80 cm) of water would flow over the dam during a Standard Project Flood assuming a maximum pool elevation of 902.6 feet (275.1 m). From Creek Road to the east abutment, and for a short distance at the west abutment, the embankment is designed as a non-overflow section with a top elevation of 905.5 feet (275 m) and grassed slopes.

The principal outlet works for the lower reservoir would consist of a control structure, stilling basin, and outlet channel located 900 feet (275 m) east of the intersection of the lower dam and Tonawanda Creek. The control structure would be a four-conduit reinforced concrete box culvert with the capacity to pass flows of up to 6,000 cfs (168 cms) under the 500-year flood condition. Each conduit would be 11 feet wide by 11 feet high (3.4 x 3.4 m) and equipped with an electrically operable fixed wheel control gate. An upstream inlet flume would funnel water into the gated conduits. The inlet flume would consist of a reinforced concrete section located adjacent to the control gates and steel sheet-pile wingwalls. The channel bottom between the wingwalls would be protected with 24-inch (60 cm) riprap placed on 12-inch (30 cm) bedding layer. The riprap would extend from the concrete floor slab to a line 10 feet (3 m) upstream of the wingwalls. The stilling basin would be a reinforced concrete structure 48.5 feet (14.8 m) wide and 62 feet (18.9 m) long with a raised end sill 4 feet (1.2 m) high. A new inlet channel, starting at the inlet flume, would be excavated normal to the dam and would extend upstream for approximately 500 feet (152 m) to a junction

with the existing creek channel. A new outlet channel, starting at the stilling basin, would be excavated normal to the lower dam and would extend downstream for approximately 100 feet (30.5 m) to a junction with the existing creek channel. The outlet channel bottom, flaring from a width of 48.5 feet (14.8 m) at the stilling basin to 70 feet (21.3 m), would be protected with 24-inch (60 cm) riprap placed on a 12-inch (30 cm) bedding layer for its entire length. The meandering Tonawanda Creek channel immediately upstream from the lower dam and west of the principal outlet works would be abandoned.

Several non-overflow training dikes would be located along the east and west sides of the Tonawanda Creek valley (Fig. 1). Along the east side, a dike would stretch 950 feet (290 m) across a natural saddle located approximately 1,000 feet (305 m) south of East Road. Along the west side, three dikes would be located approximately 500 feet (152 m) east of Route 98 in the reach between Cookson Road and the Lehigh Valley Railroad (Conrail) embankment. These dikes would stretch 3,330 feet (1,015 m), 600 feet (183 m), and 150 feet (46 m) across low areas in order to prevent possible overtopping of Route 98. The maximum height of these dikes varies from 5.5 to 9 feet (1.7-2.7 m). To provide the required interior drainage, each dike would have a gated culvert consisting of a 24- to 36-inch (60-90 cm) diameter reinforced concrete pipe, reinforced concrete headwalls and wingwalls, and automatic flap gates mounted on the reservoir side of each dike.

The two dams and four training dikes would be earthen fill structures having 1 vertical on 3 horizontal side slopes; the dikes would be seeded and the dams riprapped on both upstream and downstream faces. The riprap would be chinked with 6 inches (15 cm) of topsoil and seeded with crown vetch.

Construction of the dams and dikes would require stripping an area of 35.6 acres (14.4 ha). Of this total, 14.3 acres (5.8 ha) would be cleared and grubbed. Also, construction of the dams and dikes would require the filling-in of 8.9 acres (3.6 ha) of wetland associated with the lower reservoir.

Downstream from the upper reservoir a section of Peaviner Road and the existing bridge over Tonawanda Creek would require relocation due to the realignment of the creek channel in the vicinity of the principal outlet works. A 60-foot (18 m) span highway bridge would be provided over the new outlet channel from the principal outlet works. The abandoned Lehigh Valley Railroad (Conrail) bridge over Tonawanda Creek would be permanently removed to improve hydraulic conditions downstream of the lower reservoir.

The existing Tonawanda Creek channel within the lower reservoir would be cleared of snags and debris jams to ensure a channel capacity of roughly 2,000 cfs (56 cms). Dead trees along the channel banks and overhanging, partially uprooted trees would also be removed. The sections of abandoned creek channel would be utilized as spoil areas for waste materials from clearing and stripping operations associated with the construction of the upper and lower dams and from clearing and snagging operations along the existing creek channel within the lower reservoir.

Under the present plan, all lands lying within the reservoir floodpool boundaries would be placed under flowage easement with the private landowners. These lands could still be farmed, but 37 residences and 3 farmsteads in the lower reservoir and 8 residences in the upper reservoir would have to be purchased and removed.

## DESCRIPTION OF AQUATIC AND TERRESTRIAL ECOSYSTEMS

### General

The Tonawanda Creek Watershed, an area of about 648 square miles (1,678 square kilometers), is located in western New York and includes portions of Erie, Genesee, Niagara, Orleans, and Wyoming counties. It occupies parts of two physiographic provinces -- the Appalachian upland and the Erie-Ontario lowland. Tonawanda Creek, the major stream of the watershed, rises in the Cattaraugus Hills in the Town of Wethersfield in Wyoming County. From its source, approximately 1,929 feet (588 m) above sea level, the creek flows northward approximately 22 miles (35 km) through deep valleys with steep sides and slopes to enter the Erie Plain near the Village of Attica. From Attica, the creek continues to flow northward for nearly 20 miles (32 km) through essentially flat bottomland to the City of Batavia, where erosion resistant rock formations of the Onondaga Escarpment turn the creek's channel to a westward flow through the Erie Plain. Lands surrounding the creek and its tributaries consist primarily of farm fields and various types of natural open space, including grass fields, wetlands, brush, and forests. The creek also passes through residential, commercial, and industrial areas in the villages of Attica and Alexander, and in the City of Batavia.

### Aquatic Resources

The portions of Tonawanda Creek and its tributaries lying within the project area are designated Class "A" waters by the New York State Department of Environmental Conservation (NYSDEC). Class "A" is the highest water quality category in New York's classification system, but the NYSDEC does not consider this area to be trout inhabited water (Class "A(t)"). While trout are not normally stocked in these waters, some brown trout have been found in the Little Tonawanda Creek tributary (Table 1).

A wide diversity of aquatic macro-invertebrates have been collected from Tonawanda Creek and the Little Tonawanda Creek tributary (Great Lakes Laboratory, 1976). In both creeks the aquatic macro-invertebrates collected were primarily indicative of relatively unpolluted stream conditions. The dominant macro-invertebrate groups sampled were amphipods, anisopterans (dragonflies), dipterans (midges, true flies, horse flies, and black flies), coleopterans (water beetles), hemipterans (water boatman, water striders, and water scorpions), decapods (crayfish), ephemeropterans (mayflies), gastropods (snails), isopods, lepidopterans (water moths), megalopterans (alderflies), oligochaetes (aquatic earthworms), sphaeriids (clams), trichopterans (caddisflies), and zygopterans (damselflies).

Tonawanda Creek meanders through numerous farm fields, but is relatively undisturbed by most farm-related activities. However, intensive agricultural practices in the watershed tend to increase water runoff and thereby result in an increased sediment load in the creek during wet periods. The creek also passes through brushlands and forested areas, and is well-shaded for most of its length by a thick growth of riparian vegetation. This shading tends to create a cool, glen-like situation along the creek, even during the warmest days of summer. The banks are steeply sloping and usually consist of sand or clayey mud. Fallen trees and branches stretch across the creek in many places, and these snags tend to collect woody debris behind them. Turbid conditions seem to prevail throughout the year, with the creek being clearest during low-flow conditions (usually in summer) and most turbid during periods of peak runoff. Current in the main creek channel is relatively slow and water depth is variable, ranging from as little as 4 inches (10 cm) in riffle areas to greater than 4.3 feet (1.3 m) in deep pools (Bio Systems Research, 1979). The largest tributary of Tonawanda Creek, Little Tonawanda Creek, varies greatly in character: the upstream stretches are low, clear, rocky, and have moderate flow, whereas the downstream stretches are more turbid, silt-laden, and have a slow current (ibid.). Several other tributaries are present and their physical conditions vary like those of Little Tonawanda Creek. A number of ponds and oxbows are located in the project area. These lentic environs are warm, turbid, have mud bottoms, and are sometimes connected to channels having intermittent flow conditions.

Fishing in Tonawanda Creek occurs primarily in the vicinity of automobile and railroad bridges, where access is best. Float-fishing is possible, but difficult because of snags and debris jams in the creek. Small tributaries, ponds, and oxbows are fished quite readily from shore. Sport fishes sought include smallmouth bass, largemouth bass, and northern pike. Brown trout are present in Little Tonawanda Creek and they probably sustain some fishing pressure. Available panfish species include the pumpkinseed, bluegill, green sunfish, rock bass, yellow

perch, and brown bullhead. Numerous forage fish are also present. A total of 29 species of fish have been found to occur in this portion of the watershed (Table 1).

Terrestrial Resources

Terrestrial vegetation consists primarily of cropland, hayfield, pasture, emergent marsh, shrub swamp, and forested wetland. These cover types also encompass wet meadows, riparian hardwood stands, and vegetation associated with railroad rights-of-way. Farmlands consisting of hay, pasture, and crops of corn, sunflowers, and beans tend to dominate the landscape.

Wet meadows are the most homogeneous of existing cover types and are dominated by introduced species of yellow and white iris. Other plants found in association with the iris were skunk cabbage, purple loosestrife, and various sedges and grasses. Few vertebrates were found in association with this cover type and those that do occur are usually associated with open water pools, or are only seasonally present. Gray treefrogs, leopard frogs, bullfrogs, kingbirds, bobolinks, red-winged blackbirds, barn swallows, spotted sandpipers, mallard ducks, and muskrats have been found in association with this cover type in late spring and summer, and migrating shorebirds and waterfowl have been observed to make extensive use of these areas in spring and fall.

Emergent marshlands typically have a heterogenous mixture of open water and several species of cattail. Other plants found in association with cattail marshes were willow, purple loosestrife, yellow iris, white iris, water parsnip, water hemlock, nightshade, sensitive fern, and various horsetails, sedges, and grasses. These areas usually have some standing water throughout the year and have much intrinsic value to wildlife. Some species, including many frogs, toads, salamanders, and birds, require these areas for their seasonal breeding activities and for the development and the raising of young. Other species, such as barn swallows, tree swallows, and kingfishers, use these areas solely for feeding, whereas fish, green frogs, bullfrogs, water snakes, aquatic turtles, and some birds are year-round residents. Migrating waterfowl, herons, and shorebirds use these areas extensively in spring and fall.

Shrub swamps are comprised of woody species such as red-osier dogwood, silky dogwood, arrow-wood, buckthorn, slippery elm, hawthorne, willow, eastern cottonwood, and white and green ash. Herbaceous species present include purple loosestrife, yellow iris, bindweed, Joe-Pye-weed, and various grasses, sedges, and legumes. Wildlife use is extensive and many resident and non-resident species have been observed in these areas (Table 2). Most shrub species provide an important winter food resource for resident birds and mammals, and for migrant birds in spring and fall.

Forested wetlands vary from permanently flooded to seasonally dry and the plant species composition tends to vary with the moisture regime. The wettest areas are dominated by green ash, silver maple, red maple, and willow. Other species associated with wet areas include silky dogwood, buttonbush, slippery elm, honeysuckle, water parsnip, water plantain, cardinal flower, and fringed loosestrife. Drier sites are dominated by American beech, shagbark hickory, bitternut hickory, red oak, white oak, and sugar maple. Other species in dry sites include silver maple, green ash, choke cherry, ironwood, witch-hazel, buckthorn, hawthorne, wild grape, wild rose, woodbine, Christmas fern, blue cohosh, enchanter's nightshade, beggarticks, and May-apple. Forested wetlands have a diverse vertebrate fauna associated with them (Table 2) and are an important component of the terrestrial ecosystem, providing, for example, many nesting sites for birds, denning sites for snakes and mammals, and cover for terrestrial amphibians.

Railroad rights-of-way possess a diverse floral association that includes forests, shrublands, and old-field herbaceous situations. Species most intimately associated with these rights-of-way include hawthorne, slippery elm, staghorn sumac, willow, box-elder, common elderberry, arrow-wood, buckthorn, red-osier dogwood, woodbine, and wild grape. Herbaceous species found were numerous and include teasel, milkweed, Queen Anne's lace, poison-ivy, cow parsnip, touch-me-not, sorrel, curled dock, and various grass species. The faunal component was equally diverse (Table 2), while the diversity of both the flora and fauna seemed richest on the unmanaged and abandoned rights-of-way.

In general, and as a group, amphibians are well represented in the project area (Table 2) and they are quite abundant. The consistently damp soil conditions seem to favor frogs and toads, but may be limiting for salamanders. Seasonal ponds, emergent marshes, shrub swamps, and forested wetlands are used by these species for their spring breeding activities. Green frogs and bullfrogs spend both their larval and adult life stages in these aquatic habitats, whereas wood frogs, gray tree frogs, spring peepers, American toads, and the Jefferson's and blue-spotted salamanders spend their adult life in shrubby and wooded areas. Adult western chorus frogs and northern leopard frogs spend the summer in grassy fields and wet meadows. The more aquatic amphibians, including the green frog, bullfrog, and northern leopard frog, overwinter in the mud at the bottom of aquatic habitats, whereas the more terrestrial species tunnel into the soil of upland habitats.

Reptiles are represented by at least six snakes and three turtle species (Table 2), but this group is generally quite secretive and could be more diverse than is indicated by the available information. Snakes are wide ranging and utilize most of the various habitats available to them in the project area, with the exception of water snakes which are restricted to aquatic areas. The three turtle species are primarily aquatic; the

painted turtles and snapping turtles being most common in ponds, marshes and swamps, whereas the wood turtles are restricted to streams and associated riparian habitats and forested wetlands.

The avian component constitutes a visible and integral part of the Tonawanda Creek basin fauna. In numbers of species, birds were the most abundant vertebrate group. A diversity of habitat types interspersed with intensive agriculture provided what seemed to be excellent conditions for successful avian reproduction. Avian species observed during spring and summer breeding bird surveys in 1979 are listed in Tables 2 and 3. Birds observed in the basin during spring and summer, but not known to breed there, were the great blue heron, great egret, American bittern, and red-bellied woodpecker.

Aside from the use of the basin by breeding birds, there is considerable use of the area during spring and fall by migrants, and in summer by non-breeders. In the spring of 1979, two separate flocks of approximately 800-1,000 Canada geese each were observed on partially flooded farmlands at two locations near the main creek channel and within the bounds of the lower reservoir floodpool. The basin seems to serve as an alternative feeding and resting area for the enormous numbers of migrating ducks and geese that stop at nearby Iroquois National Wildlife Refuge each spring. Great blue herons, usually single but sometimes in flocks of 10-12, were observed throughout the basin during the spring and summer of 1979. One such flock was observed regularly in the large wetland complex near the junction of the Erie and Delaware Lackawanna (Conrail) railroads.

A diverse mammalian fauna is present in the Tonawanda Creek watershed (Table 2) and a wide variety of habitats are utilized, including marshes, swamps, forests, and agricultural lands. Mink, muskrats, raccoon and white-tailed deer seemed most abundant and were found in very close association with Tonawanda Creek and adjacent forested wetlands. Two important fur-bearers, beaver and river otter, were not observed during field reconnaissance, but both species have been previously reported from the Batavia-Alexander area by State biologists.

Public hunting is permitted on many private lands through cooperative agreements between landowners and the New York State Department of Environmental Conservation. The trapping of furbearers is also pursued, but there is no provision for this activity on Coop lands. Game species taken by hunters include raccoon, red fox, eastern gray squirrels, eastern cottontail rabbits, white-tailed deer, woodcock, ring-necked pheasant, and various ducks, geese, and rails. Furbearers taken by trappers include mink, muskrat, and raccoon.

The five major terrestrial habitat or land-use types in the project area were evaluated by an interagency team on September 20-21, 1979 using the Service's Habitat Evaluation Procedures (U.S. Fish and Wildlife Service, 1979a). Baseline habitat data were established by measuring and/or estimating the physical and vegetative habitat characteristics important to the wildlife species used in the evaluation. The evaluation elements (wildlife species) utilized (Table 4) were selected as being representative of the wildlife forms present in the project area and include species that are: (1) economically important; (2) of high public interest; (3) good indicators of habitat quality; and (4) of particular interest due to restricted range, high vulnerability, and/or special habitat requirements. The habitat inventory characteristics measured and/or estimated (Table 5) were derived from life history accounts developed for this particular evaluation (U.S. Fish and Wildlife Service, 1979b). Cover maps were prepared (Figures 2 and 3) and surface area was estimated based on maximum floodpool elevations provided by your staff in August, 1979, (922.5 feet (281.2 m), upper floodpool; 900 feet (274.3 m), lower floodpool). Table 6 depicts the baseline Habitat Suitability Indices (HSI), the surface area (hectares), and the Habitat Units (HSI x hectares) determined for each habitat type. HSI is an estimate of the relative value of a particular habitat type to the wildlife species used in the evaluation. For comparison, forested wetland received the highest rating for wildlife (HSI=0.803) and cropland the lowest (HSI=0.605).

## PROJECT IMPACTS ON AQUATIC AND TERRESTRIAL ECOSYSTEMS

### General

No comprehensive studies have been made to assess the effects of dry dams and their operation on either aquatic or terrestrial ecosystems; therefore the beneficial and adverse impacts of the Batavia Reservoir Compound on fish and wildlife are treated primarily in terms of the impacts that we are best able to evaluate. These are generally short-term effects, but the long-term effects of dry dams are also considered where there is sufficient information available to undertake a cogent analysis of potential project impacts.

### Aquatic Resources

The construction of dry dams, lateral dikes, and outlet works could result in the potential for erosion of soil into the creek and the re-suspension of bottom sediments, resulting in an increased level of turbidity in the creek in the immediate vicinity of and downstream from project construction and maintenance activities. The increased level of

turbidity could then stress fish and macro-invertebrate populations, especially fish eggs and larvae, which are particularly sensitive to changes in the concentration of suspended solids. Filter-feeding invertebrates would be the most adversely affected invertebrate group. However, fish are usually more sensitive to suspended solids than are most invertebrates. Stern and Stickle (1978) reviewed the effects of turbidity in aquatic environments and listed: (a) thickening of gill lamellae, (b) excessive mucous secretion, (c) abrasion of branchial epithelium, and (d) respiratory distress as the potential stressing effects on fish from high concentrations of suspended solids. They also cited the clogging of opercular cavities and gill filaments with clay particles as factors leading to death. Suspended solids were reported to cause a delay in the hatching of fish eggs, often for several hours. Turbidity and suspended solids concentrations lower than those necessary to cause death or physiological injury may also produce other responses, including a disturbance in the normal population social structure and a general reduction in activity that may reduce the fishes ability to locate food and increase their susceptibility to predation (Heimstra et al., 1969). Many of these effects would be expected to occur during and immediately following construction activities. They would be particularly adverse if construction were to take place during late spring and early summer when most fish breed (spawn) and when eggs, larvae, and young fish are developing. High suspended solids concentrations would be least harmful to fish if they were present during the winter months rather than in summer.

The retention of flood waters and their regulated release would have both beneficial and adverse effects on the aquatic ecosystem. Reservoir regulated discharges, which are held at or below the bank-full stage most of the time, would reduce bank erosion and bed scour and decrease the amount of sediment picked up from the stream bed or brought in from the flooding of bottomlands (Neel, 1963). These same conditions would extend under some conditions the period of increased turbidity in Tonawanda Creek beyond that found under flooding conditions without the project. Whereas most flooding would pass suspended particulate matter through in less than three days, the project would hold and release turbid floodwaters for as long as 9.8 days. Despite the settling out of suspended particulates in the reservoirs, some of the material would be resuspended by waters leaving the reservoir compounds. The prolonged turbid conditions could then severely stress fish and macro-invertebrate populations both downstream from and within each of the reservoir compounds. The potentially adverse effects of these conditions on aquatic resources would be essentially the same as those discussed in the above paragraph and they warrant no further discussion here. It should be noted, however, that while most fish will survive the normal increase in turbidity experienced under annual flooding, the effects of prolonged turbidity could be adverse.

The severity of any adverse effects would be increased if flooding were to occur during late spring or summer when many fish species are breeding (spawning) and when eggs, larvae, and young fish are developing.

The removal of snags and debris from the main creek channel would result in both beneficial and adverse impacts. Snag removal would permit the free passage of boats along the creek and therefore result in greater opportunities for public use of fish and wildlife resources. On the other hand, the snags, debris, and associated sediment deposits create significant habitat for macro-invertebrates, fish, frogs, and turtles. Their removal would reduce both the availability and the diversity of aquatic habitats. Many aquatic insects, including collectors (caddisflies), scrapers (mayflies), and predators (stoneflies and hellgrammites), are all common inhabitants of log and debris jams (Hynes, 1970). Many fish species congregate near obstructions (ibid.), and frogs and wood turtles use them for shelter and basking sites. Sediment deposits (which would be eroded if the snags were to be removed) serve as substrates for burrowing invertebrates such as chironomids, ephemeropterans, anisopterans, annelids, crustacea, and molluscs (Hynes, 1970; Anderson et al., 1977). Detritivorous invertebrates utilize the organic matter and/or the micro-flora of sediments as a food resource (Anderson et al., 1977). Any shift or reduction in the macro-invertebrate population would cause a reduction in the productivity of fish species dependent upon that resource.

Riparian vegetation damaged or destroyed during snag removal could result in increased stream temperatures through increased incipient solar radiation received at the surface of the creek (Ringler and Hall, 1975). Increased water temperatures would significantly affect the quality of the aquatic environment, potentially resulting in a change in the structure of the aquatic community.

The construction of dry dam outlet works would inhibit to some extent the normal movements of fish species present in Tonawanda Creek. Northern pike, white suckers, and various other fish species are known to migrate to spawning areas; therefore if the outlet structures impede their passage, either physically or through changes in fish behavior, then reduced reproduction would likely occur for the affected species, along with a change in the structure of the fish community.

The flooding of one or both of the reservoir floodpools would result in some fish moving out of their normal habitat and into the temporary reservoirs. With subsequent drawdown, some stream species could become stranded in permanent pond habitats, whereas others could become stranded in ponds or pools of water that eventually go dry. In either case, some fish mortality could be expected. Should flooding occur during the spawning season of a particular species then these activities would likely be suspended and in some cases an entire season of reproduction

could be delayed or possibly lost. If developing eggs should become covered with sediments deposited by flood waters then significant mortality could be expected at that life stage.

Terrestrial Resources

Construction of the Tonawanda Creek Flood Control Project would necessitate the stripping of about 35.6 acres (14.4 ha) of wildlife habitat for dry dam and lateral dike placement. These habitats provide shelter, food resources and breeding sites for many amphibians, reptiles, birds, and mammals found in and around the location of the proposed flood management structures. We estimate that approximately 9.2 Habitat Units would be lost due to the construction of these structures (Table 7).

Streamside activities necessary for snag removal would disturb riparian vegetation that both stabilizes the creek banks and provides wildlife cover. Riparian areas would be further affected by the placement of dams across the creek and the abandonment and filling-in of portions of the creek channel. These areas provide optimal habitat for some species such as the mink and wood turtle, thus damage to riparian areas could have significantly adverse effects on wildlife found in that habitat, including a significant reduction in species diversity and carrying capacity in remaining habitat.

Many amphibians, reptiles, birds, and mammals could be significantly affected by complete inundation of terrestrial habitats. Whereas most vertebrate communities can adapt to a permanent change in water level, they cannot respond effectively to rapid and irregular short-term inundation; therefore significant mortality could occur, especially during the breeding/nesting season should inundation occur at that time. For reptiles and birds, inundated eggs and/or young would result in a significant loss of embryos and/or nestlings for a particular year. Similar mortality could occur for mammalian young should their dens or nests become flooded while the young are still in early stages of development. Flood-water inundation would force many wildlife forms to higher, unflooded areas resulting in unnaturally high concentrations of wildlife on floating debris and on projecting trees and land areas. These concentrations would then result in increased predation and competition, and also in increased stress that would likely result in death for some individuals. Thus, the short-term effects of flood-water inundation could be significantly adverse.

The physical presence of the dry dams would act as a barrier to the normal movement and dispersal of many vertebrate species. Smaller vertebrates, such as salamanders that migrate to breeding ponds, would be most affected, whereas large species, such as deer, would have sufficient mobility to pass around the ends of the flood control structures and therefore would be less affected.

The inundation of terrestrial habitats by flood waters retained by the proposed dry dams would result in some significant adverse impacts on wildlife resources and their habitats. The most severe changes in plant species composition and abundance would likely occur in areas immediately upstream of the dry dams. These areas often become "mudflats", as they are flooded most frequently and for the longest duration, and because suspended sediments and debris tend to be deposited there. Erosion and sedimentation are continuous processes on reservoir mudflats and successive floodings tend to keep vegetation in an immature state (Wilson and Landers, 1973). The current trend of keeping much of the upper reservoir lands in hay and rowcrops (about 37 percent of the total area), as well as the greater duration of flooding expected with project implementation, will act to hasten the early development of mudflats in the upper floodpool. Mudflat formation in the lower reservoir is expected to be less severe due to the lesser frequency of flooding there, although the percentage of land in hay and pasture is essentially the same (about 39 percent of the total area).

Flooding imposes complex stresses on many vascular plants, most of which arise from the depletion of oxygen in the flooded soil (Whitlow and Harris, 1979). In addition to anaerobic soil conditions, plant age, plant size, flood depth, flood duration, flood timing, substrate composition, siltation, and wave and ice action are all factors that determine survivorship when plants are flooded (McKim et al., 1975; Whitlow and Harris, 1979). The time at which a flood occurs during the growing season, along with the duration or period that an area is flooded, can have a significant impact on the survival of vegetation. Whereas dormant season flooding usually has no effect on woody plants, seedlings flooded after leaf flush are very susceptible to damage (Broadfoot and Williston, 1973). In a study of six New England flood control reservoirs, McKim et al. (1975) observed that smaller (less than 14-inch diameter) and younger trees were more affected by inundation than larger, mature trees, but that all trees inundated for more than 90 hours were affected to some degree. These authors further observed that ice conditions associated with winter flooding caused extensive damage to trees on floodplains. Low-growing, shrubby vegetation is very susceptible to flood damage, but may recover quickly through resprouting.

To determine the effects of operating the proposed Batavia Reservoir Compound (modified) on the terrestrial ecosystem, we estimated without- and with-the-project Habitat Unit changes and net average annual gain and loss of Habitat Units according to habitat type (Tables 8, 9, and 10, respectively). The data show a net gain of 10[illegible].4 Habitat Units for emergent marsh (EM) and pasture (P) habitat, and a net loss of 421.2 Habitat Units for shrub swamp (SS), forested wetland (FO), and cropland

(C) habitat. The indicated Habitat Unit changes reflect predicted annual changes in plant species composition and community structure that would likely result from flood-water inundation, mudflat formation (sedimentation), and natural and project-influenced plant succession, and presume that the following assumptions would hold true should the project, as described herein, be implemented:

1. That currrent land-use patterns would remain unchanged over the life of the project (100 years).

2. That 35% of the upper floodpool lands and 5% of the lower floodpool lands would develop into unstable mudflats under with-the-project conditions and that all mudflats would form within the first 25 years of project life.

3. That all habitat types would be equally affected by mudflat formation, except that emergent marshlands in the lower floodpool would remain unaffected (0% loss) and that cropland in the upper floodpool would be severely affected (60% loss).

4. That the mudflats would have little or no wildlife value (HSI=0.000).

5. That the following changes in habitat composition would occur over the period of analysis due to natural and project-induced plant succession:

| | Without-the-Project Conditions | | | With-the-Project Conditions | | |
|---|---|---|---|---|---|---|
| | Present Habitat | % of Habitat Converted | Resulting Habitat | Present Habitat | % of Habitat Converted | Resulting Habitat |
| Upper Pool | EM | 0% | EM | EM | 0% | EM |
| | SS | 75% | FO | SS | 50% | FO |
| | FO | 0% | FO | SS | 25% | EM |
| | P | 25% | SS | FO | 20% | EM |
| | C | 0% | C | P | 25% | SS |
| | -- | --- | -- | P | 25% | EM |
| | -- | --- | -- | C | 20% | SS |
| | -- | --- | -- | C | 20% | EM |
| Lower Pool | EM | 0% | EM | EM | 0% | EM |
| | SS | 80% | FO | SS | 80% | FO |
| | FO | 0% | FO | FO | 10% | EM |
| | P | 10% | SS | P | 10% | SS |
| | C | 0% | C | P | 10% | EM |
| | -- | --- | -- | C | 20% | SS |

Construction of the project would result in the loss of some public access to lands and waterways in the basin and in the freedom of movement across lands and along watercourses. The loss of public access to terrestrial and aquatic areas would occur primarily through construction of the dry dams. These structures would deter, to some extent, the public's ability to enjoy the benefits of the area's wildlife resources. Of particular significance would be the severing of the Batavia-Alexander Recreational Trail by the lower dam. The trail is currently owned by Genesee County and is essentially that portion of the abandoned Erie Railroad right-of-way that runs from Law Street to Peaviner Road. This elevated pathway passes through a diverse assemblage of habitat types (Fig. 3) and possesses a unique floral association that is attractive to various forms of wildlife. The trail is currently used for hiking and cross-country skiing, as well as for fish and wildlife related recreational activities such as fishing and bird-watching. Genesee County plans to resurface and in other ways improve this pathway for multiple recreational uses. Estimates of public use show moderate (present) to heavy (projected) use of the trail:

| | Present Use/Unimproved (persons-per-day) | Projected Use/with Improvements (persons-per-day) |
|---|---|---|
| Weekdays | 15-25 | 60-80 |
| Weekends | 30-40 | 100-250 |

With the construction of the lower dam the right-of-way would become a dead-ended structure and decrease in its realized and potential recreational value.

## PLAN OF DEVELOPMENT FOR AQUATIC AND TERRESTRIAL ECOSYSTEMS

In order to protect aquatic resources, a plan should be developed by the Corps of Engineers in cooperation with and approved by the New York State Department of Environmental Conservation, the U.S. Fish and Wildlife Service, the U. S. Soil Conservation Service, and the U. S. Environmental Protection Agency, to minimize the amount of project-caused erosion, siltation, and water pollution in Tonawanda Creek and its tributaries during and immediately after construction.

To mitigate the potentially adverse effects of the dry dams on normal fish movements in Tonawanda Creek, outlet works associated with the upper and lower dams should be constructed in such a manner as to permit upstream-downstream fish passage during normal flow (non-flood) conditions. A plan detailing the provisions and/or facilities for fish passage through the outlet works should be prepared by the Corps of Engineers in cooperation with and approved by the New York State Department of Environmental Conservation and the U. S. Fish and Wildlife Service. All necessary structures should be incorporated into the overall design, construction, operation, and maintenance plan for this project, and they should be provided at project cost.

All construction activities associated with instream or streambank areas, including snag removal, should be restricted to a period when impacts on fish and wildlife resources would be minimal. We anticipate that the least damage to those resources would be incurred if construction were to take place during the period from July 15 through November 15, when surface runoff and stream flow are generally lowest, and thus avoiding both the critical overwintering period and the breeding season of many fish and wildlife species.

Prior to the removal of snags from the creek and dead trees from along its banks, a plan should be developed by the Corps of Engineers in cooperation with and approved by the New York State Department of Environmental Conservation and the U.S. Fish and Wildlife Service to minimize the adverse effects of these activities on fish and wildlife resources. The following provisions should be included in the plan: (a) that stumps and logs embedded in the creek banks be cut rather than pulled and that logs deeply embedded in the creek bottom be left undisturbed in order to maintain complexity and hence diversity in the aquatic ecosystem; (b) that large dead trees along the channel banks which are in no imminent danger of toppling into the creek be left standing to provide essential denning, nesting, resting, and feeding sites for wildlife; and (c) that streamside activities be avoided where mature riparian growth, particularly box-elder and willow, could be damaged.

Sections of Tonawanda Creek that are cut off or abandoned should be plugged at their upstream and downstream ends with clean fill to provide conservation pools for fish and wildlife and all riparian vegetation associated with these areas should be left undisturbed.

The banks of Tonawanda Creek and upland areas surrounding the proposed dry dams and lateral dikes that are disturbed during construction activities, as well as riparian areas disturbed during snag and dead tree removal, should be revegetated as soon as possible after construction to mitigate the loss of wildlife habitat. A revegetation plan should be

developed for the project in cooperation with and approved by the New York State Department of Environmental Conservation and the U. S. Fish and Wildlife Service. The plan should include the monitoring of growth conditions to ensure that revegetation is successful and the replacement of dead or dying plant species. All replanting, maintenance, and monitoring activities should be funded as project costs.

To mitigate the potentially adverse effects of prolonged flooding on fish and wildlife and their habitats, flood waters should be retained in the reservoir for the shortest period of time necessary to reduce downstream flood damages. Fish and wildlife and their habitats would then have a greater potential for recovery if the duration of flooding was minimized; however, the immediate and irreversible effects of complete inundation would still be realized and could not be mitigated.

Valuable wetland complexes should be protected from complete inundation. The more important of these areas are those wetlands located east of Old Creek Road and within the upper reservoir floodpool (stippling in Fig. 2) and east of Creek Road and within the lower reservoir floodpool (stippling in Fig. 3). Wetlands in the lower floodpool could be protected by shallow dikes and flap gates; those in the upper floodpool would require either a lengthy dike running parallel to the Erie-Delaware Lackawanna Railroad (Conrail) embankment or the raising of the railroad bed to an elevation above that of the maximum floodpool, the latter method being most desirable. However, the estimated cost for the protection of upper reservoir wetlands is $2,400,000. Because of this high cost and the potential adverse environmental effects that could result during the replacement of the railroad embankment, a more practicable solution would be to compensate for predicted resource damage and losses through in-kind compensation; that is, by purchasing another equally valuable wetland complex outside of the maximum floodpool boundaries, and subsequently managing it for fish and wildlife. The area of wetland that would need replacement is approximately 111.6 acres (45.2 ha), including 37.3 acres (15.1 ha) of emergent marsh and 74.6 acres (30.2 ha) of shrub swamp. We estimate that the protection of wetlands in the lower reservoir floodpool would cost $19,000 ($15,500 for initial construction and $3,500 for annual operation and maintenance) and that the purchase and management of wetland habitat to compensate in-kind for resource damage and losses in upper reservoir floodpool wetlands would cost $69,600 ($67,800 for initial land purchase and $1,800 for annual operation and maintenance). All funds for wetlands protection, and replacement and management, should be funded as project costs, and all needed protective structures should be incorporated into the overall design, construction, and maintenance of the flood control project.

Project-caused Habitat Unit losses should be compensated for through the purchase and management of habitat that is equivalent in wildlife value and located outside of the maximum floodpool boundary. Estimates of areas needed for compensation were determined through the coordinated efforts of biologists from the Corps of Engineers, the New York State Department of Environmental Conservation, and the U. S. Fish and Wildlife Service. Relative Importance Values (RIV's) were developed for each of the habitat types in the project area (Tables 11-13). Using the RIV's, adjustments were made from predominately cropland acreage to predominately forested wetland acreage (Table 14). Forested wetland was selected as the habitat type most desireable for acquisition (a) because it is the wetland type that would be most affected by this project, and (b) because of its high value (HSI=0.803, RIV=0.91). To ensure equitable compensation of habitat losses, all lands considered for purchase should first be rated for wildlife value by an interagency habitat evaluation team comprised of biologists from the Corps of Engineers, the New York State Department of Environmental Conservation, and the U. S. Fish and Wildlife Service. We estimate that approximately $335,700 would be needed to purchase lands for compensation of Habitat Unit losses and that $8,950 would be needed for management (annual operation and maintenance) of lands during the life of the project. All costs indicated should be funded as project costs and all lands acquired to compensate for Habitat Unit losses should be administered by the New York State Department of Environmental Conservation under a mutually agreeable plan developed by the Corps of Engineers, the New York State Department of Environmental Conservation, and the U. S. Fish and Wildlife Service. The New York State Department of Environmental Conservation has responded favorably to the possibility of managing mitigation lands resulting from this project and would most favor the purchase of lands adjacent to or near the site of the flood control project. State biologists have identified areas most desireable for acquisition (see attached Letter of Concurrence dated September 29, 1980). These areas should be given first priority for purchase when mitigation plans are finalized.

Loss of public access to lands and waterways and of free movement across lands and along watercourses should be compensated for by providing some means to walk and/or portage boats across the dams in the vicinity of the main creek channel and to permit passage along the Batavia-Alexander Recreational Trail. These problems could be remedied by (a) the construction of paths or stairways across the dams in the vicinity of the main creek channel, and (b) the construction of a sloping, earthern-fill ramp from the surface of the recreational trail to the top of the lower dam where it crosses the trail. With snag removal in the main creek channel, it

could be expected that float-fishing and other boating recreation in the creek would increase; therefore it would be essential to provide a means to facilitate portaging, as well as to provide safe passage across the dams for hunters, fishermen, etc. The construction of paths or stairways would facilitate public use of fish and wildlife resources and compensate, in part, for loss of public access to and across lands in the basin. Use of the Batavia-Alexander Recreational Trail is also expected to increase as Genesee County plans to resurface and in other ways improve this pathway for multiple recreational uses. Bird-watching, fishing, and other fish and wildlife related recreational activities are permitted on and along the trail. The raising of the recreational trail (where it would be crossed by the lower dam) would serve to maintain the trail's integrity and would ensure full public use of the trail and access to and across lands in the basin. We estimate that approximately $14,500 would be needed to provide for stone stairways on each of the dry dams ($11,500 for initial construction and $3,000 for annual operation and maintenance) and that $10,000 would be needed to elevate the recreational trail ($8,000 for initial construction and $2,000 for annual operation and maintenance). These costs should be funded as project costs and the recommended structures should be incorporated into the overall design, construction, operation, and maintenance plan for this project. Further, all Federal lands and waters in the project area should be open to the public for fish and wildlife related recreational uses.

The Batavia Reservoir Compound (modified) should be used as a model for future assessments of beneficial and adverse effects of irregularly flooded dry dam structures and of measures necessary to mitigate any adverse effects. Since no studies have ever been made of the effects of dry dams and their operation on aquatic and terrestrial ecosystems, such studies should be undertaken in association with this flood management project. Studies should be planned to collect biological data on both aquatic and terrestrial ecosystems prior to and during the construction phase of the project and on ecosystem conditions during a period of at least four years following project completion. In addition to its potential use in relation to other dry dam projects, this study could also provide information useful in mitigating the adverse effects of the Batavia Reservoir Compound (when completed) through procedures such as correcting the rate of outflow or lowering maximum floodpool elevations. We estimate that approximately $96,000 would be needed to fund studies necessary to determine:

1. The short-and long-term effects of irregular inundation on plant and animal community structure.

2. The degree of silting and sedimentation that can be expected from dry-dam operation and the effects of sedimentation on plant and animal communities.

3. The effects of dry-dams, dikes and outlet works on fish and wildlife movements in the area of project influence.

4. The effects of snag removal on the structure and functioning of the aquatic community and on public uses of the creek.

5. How reservoir outflow might be manipulated to achieve needed flood protection and to concurrently minimize the adverse effects of the project on fish and wildlife.

Prior to project construction, a plan of study should be developed by the Corps of Engineers in cooperation with and approved by the U. S. Fish and Wildlife Service and the New York State Department of Environmental Conservation. The estimated $96,000 needed to fund the studies should be applied for through the Corps of Engineers Research and Development Program.

## AN ALTERNATIVE PLAN FOR FLOOD MANAGEMENT

Of the alternatives presented by your agency for flood management in the Tonawanda Creek watershed, the Batavia Reservoir Compound (unmodified plan) was selected by the Service as having the least potential adverse impact on fish and wildlife resources. We feel, however, that an additional alternative exists that has not previously been considered by your agency. This alternative would likely have fewer impacts on fish and wildlife and could actually enhance existing aquatic and terrestrial ecosystems. This alternative is a combination of both natural and managed flood control.

Existing bottomland habitats in the watershed have the potential for use as a system of natural flood control utilizing some management features. Under present conditions, many wet meadow, emergent marsh, shrub swamp, and forested wetland habitats are only seasonally flooded and during the course of spring and summer months they lose much standing water. These habitats would have greater intrinsic value to fish and wildlife if water levels were more stable. A diverse group of vertebrates, including many fish, amphibians, reptiles, waterfowl, herons, and furbearing mammals, would benefit from the stabilization of water levels, and fish and wildlife related recreational opportunities, including fishing, trapping, hunting, and bird-watching would be greatly improved.

Existing wetland habitats in the watershed could be modified with structures such as shallow levees with overflow outlet works that would retain floodwaters and maintain more seasonally stable water levels as well as increase flood storage capacity. Additional floodwater storage could be created in suitable areas through the construction of overflow diversion channels that would divert high flow water to some existing retention areas as well as to newly-created off-channel impoundments. These impoundments should be slow-draining with minimum-level conservation pools that would permit the development of aquatic and semi-aquatic plant associations. Off-channel impoundments, as opposed to the proposed dry-dams, would preserve the integrity of the Tonawanda Creek channel, as well as its ecology, and would provide needed floodwater storage, as well as create good fish and wildlife habitat.

Our proposal to use wetlands for floodwater storage is not a new concept, but even in the most ideal situation there is a need for man's assistance to promote natural watershed storage. For example, along the Charles River in Massachusetts, upper and middle watershed wetlands retain floodwaters and release them slowly, thereby lessening potential flooding problems in the lower reaches; but even so, many of the watershed's roadways have undersized culverts and bridge openings which turn the roadways into effective floodwater retention structures that increase the capacity and effectiveness of existing wetlands (U. S. Corps of Engineers, 1972). The Tonawanda Creek watershed has many wetlands whose flood retention capability could be enhanced and many non-wetland areas that could be developed into wetland/flood retention features of the ecosystem; however, such a plan would require the combined efforts and cooperation of engineers and biologists to formulate a managed/natural flood control plan for the Tonawanda Creek Watershed that is both engineeringly feasible and ecologically sound.

Since a managed/natural flood control plan would be an alternative to the Batavia Reservoir Compound (modified), all land and flowage easement purchases, and construction, and annual operation and maintenance costs should be funded as project costs. The lands and management structures could be administered by the New York State Department of Environmental Conservation under a mutually agreeable plan developed by the Corps of Engineers, the New York State Department of Environmental Conservation, and the U. S. Fish and Wildlife Service.

## RECOMMENDATIONS

We recommend that:

1. A system of managed/natural flood control, as described herein, be given full consideration by your agency as a project alternative -- one that can potentially protect fish and wildlife resources and preserve ecosystem integrity, as well as provide the needed flood control in Tonawanda Creek Watershed. We further recommend that the managed/natural flood control alternative be developed through the combined efforts of the Corps of Engineers, the U. S. Fish and Wildlife Service, and the New York State Department of Environmental Conservation, and that if found feasible be implemented in lieu of the Batavia Reservoir Compound (modified).

2. The Batavia Reservoir Compound (modified), if constructed, be used as a model for future assessments of beneficial and adverse effects of irregularly flooded dry dam structures on aquatic and terrestrial ecosystems, and that the studies described herein be undertaken to provide the data base necessary for such assessments. We further recommend that, prior to project construction, a plan of study be developed by the Corps of Engineers in cooperation with and approved by the U. S. Fish and Wildlife Service and the New York State Department of Environmental Conservation, and that the estimated $96,000 needed to fund the studies be applied for through the Corps of Engineers Research and Development Program.

3. Prior to project construction, a plan be developed by the Corps of Engineers in cooperation with and approved by the New York State Department of Environmental Conservation, the U. S. Fish and Wildlife Service, the U. S. Soil Conservation Service, and the U. S. Environmental Protection Agency, to minimize the amount of project-caused erosion, siltation, and water pollution in Tonawanda Creek and its tributaries during and immediately after construction.

4. To mitigate the potentially adverse effects of the dry dams on normal fish movements in Tonawanda Creek, outlet works associated with the upper and lower dams be constructed in such a manner as to permit upstream-downstream fish passage during normal flow (non-flood) conditions. We further recommend that a plan detailing the provisions and/or facilities for fish passage through the outlet works be prepared by the Corps of Engineers in cooperation with and approved by the New York State Department of Environmental Conservation and the U. S. Fish and Wildlife Service, that all necessary structures be incorporated into the overall design, construction, operation, and maintenance plan for this project, and that they be provided at project cost.

5. All construction activities associated with instream or streambank areas, including snag removal, be restricted to the period from July 15 through November 15, when surface runoff and stream flow are generally lowest, and thus avoiding both the critical over-wintering period and the breeding season of many fish and wildlife species.

6. Prior to removal of snags from the creek and dead trees from along its banks, a plan be developed by the Corps of Engineers in cooperation with and approved by the New York State Department of Environmental Conservation and the U. S. Fish and Wildlife Service to minimize the adverse effects of these activities on fish and wildlife resources. We further recommend that the following provisions be included in the plan: (a) that stumps and logs embedded in the creek banks be cut rather than pulled, and that logs deeply embedded in the creek bottom be left undisturbed in order to maintain complexity and hence diversity in the aquatic ecosystem; (b) that large dead trees along the channel banks which are in no imminent danger of toppling into the creek be left standing to provide essential denning, nesting, resting, and feeding sites for wildlife; and (c) that streamside activities be avoided where mature riparian growth, particularly box-elder and willow, could be damaged.

7. Sections of Tonawanda Creek that are cut off or abandoned be plugged at their upstream and downstream ends with clean fill to provide conservation pools for fish and wildlife and that all riparian vegetation associated with these areas be left undisturbed.

8. Streambanks and upland areas surrounding the proposed dry dams and lateral dikes disturbed during construction activities as well as riparian areas disturbed during snag and dead tree removal, be revegetated as soon as possible after construction to mitigate the loss of wildlife habitat. We further recommend that prior to project construction, a revegetation plan be developed for the project in cooperation with and approved by the New York State Department of Environmental Conservation and the U. S. Fish and Wildlife Service, that the plan include the monitoring of growth conditions to ensure that revegetation is successful and the re-placement of dead or dying plant species, and that all replanting, maintenance, and monitoring activities be funded as project costs.

9. To mitigate the potentially adverse effects of prolonged flooding on fish and wildlife and their habitats, that flood waters be retained in the reservoirs for the shortest period of time necessary to reduce downstream flood damages. We further recommend that prior to project constuction, operating criteria for flood water

retention and regulated release be established in cooperation with and approved by the New York State Department of Environmental Conservation and the U. S. Fish and Wildlife Service for the conservation and development of fish and wildlife resources, and that these criteria be adhered to by the Corps of Engineers as long as it exercises direct operational control of project features, and that any agreements entered into for the delegation or release of operational control to another agency include stipulations to prevent deviation from these criteria.

10. Valuable wetland complexes, located east of Creek Road and within the lower reservoir floodplool, be protected from complete inundation through the construction of lateral dikes with flap gates. We further recommend that the estimated $19,000 needed to provide protective structures ($15,500 for initial construction and $3,500 for annual operation and maintenance) be provided as a project cost and that all such structures be incorporated into the overall design, construction, operation, and maintenance plan for this project.

11. Project-caused Habitat Unit losses, including losses associated with upper reservoir wetlands, be compensated for through the purchase and management of habitat that is equivalent in wildlife value and located outside of the maximum floodpool boundary. We further recommend that the estimated $403,500 needed to purchase lands for compensation and $10,760 needed for annual management (operation and maintenance) of the lands be funded as project costs, that the management area be administered by the New York State Department of Environmental Conservation under a mutually agreeable plan developed by the Corps of Engineers, the New York State Department of Environmental Conservation, and the U. S. Fish and Wildlife Service, and that the report of the District Engineer, Corps of Engineers, include language calling specifically for Congressional authorization for the necessary land acquisition and management described herein.

12. Loss of public access to lands and waterways and of free movement across lands and along watercourses should be compensated for by providing (a) paths or stairways across the dams in the vicinity of the main creek channel, and (b) a sloping, earthen-fill ramp from the surface of the Batavia-Alexander Recreational Trail to the top of the lower dam where it crosses the trail. We further recommend that the estimated $40,000 needed to provide for stone stairways on each of the dry dams ($11,500 for initial construction and $3,000 for annual operation and maintenance) and for elevation of the recreational trail ($8,000 for initial construction and $2,000 for

annual operation and maintenance) be funded as a project cost and that these structures be incorporated into the overall design, construction, operation, and maintenance of the flood control project. Further, all Federal lands and waters in the project area should be open to the public for fish and wildlife related recreational uses.

13. All mitigation activities, including land purchases and fish and wildlife studies, be conducted under the auspices of an interagency monitoring team comprised of biologists from the Corps of Engineers, the U. S. Fish and Wildlife Service, and the New York State Department of Environmental Conservation, and that all of the activities of the monitoring team be funded as a project cost.

Please continue to coordinate this project with us as it develops, and advise us of any changes or additions to the project so that consideration may be given to revise or supplement this report.

Sincerely yours,

Paul P. Hamilton

Paul P. Hamilton
Field Supervisor

## REFERENCES


Anderson, N.H., J.R. Sedell, L.M. Roberts, and F.J. Triska. 1977. The role of aquatic invertebrates in processing of wood debris in coniferous forest streams. American Midland Naturalist 100(1):64-82.

Bio Systems Research. 1979. Fish survey, Tonawanda Creek watershed, Batavia to Alexander, Genesee County, New York, June-July 1979. Report on contract DACW49-79-C-0052 prepared for U. S. Department of the Army, Corps of Engineers, Buffalo District, Buffalo, New York. 14pp., 3 tables, 1 map.

Broadfoot, W.M., and H.L. Williston. 1973. Flooding effects on southern forests. Journal of Forestry 71:584-587.

Great Lakes Laboratory. 1976. Final report: benthic study on Tonawanda Creek, New York. Report on contract DACW49-76-C-0039 prepared for U. S. Department of the Army, Corps of Engineers, Buffalo District, Buffalo, New York. 15pp.

Heimstra, Norman W., David K. Damkot, and Norman G. Benson. 1969. Some effects of silt turbidity on behavior of juvenile largemouth bass and green sunfish. U. S. Department of the Interior, Fish and Wildlife Service, Technical Paper No. 20. 9pp.

Hynes, H.B.N. 1970. The ecology of flowing waters in relation to management. Journal Water Pollution Control Federation 42(3):418-424.

McKim, Harlan L., Lawrence W. Gatto, and Carolyn J. Merry. 1975. Inundation damage to vegetation at selected New England flood control reservoirs. U. S. Department of the Army, Engineering Division, Cold Regions Research and Engineering Laboratory, Special report No. 220. 53pp.

Neel, Joe Kendall. 1963. Impact of reservoirs. Pages 575-593 in David G. Frey, ed. Limnology in North America. University of Wisconsin Press, Madison.

Ringler, Neil H., and James D. Hall. 1975. Effects of logging on water temperature and dissolved oxygen in spawning beds. Transactions of the American Fisheries Society 104(1):111-121.

Stern, Edward M., and William B. Stickle. 1978. Effects of turbidity and suspended material in aquatic environments. U. S. Army Engineer Waterways Experiment Station, Technical Report D-78-21. 117pp.

U.S. Army Corps of Engineers. 1972. Water resources development plan, Charles River watershed, Massachusetts. Appendix H. Flood management - plan formulation. U. S. Department of the Army, Corps of Engineers, New England Division, Waltham, Massachusetts.

U. S. Army Corps of Engineers. 1979. Interim report on feasibility of flood management in Tonawanda Creek watershed: final feasibility report. Main report and technical appendices. U. S. Department of the Army, Corps of Engineers, Buffalo District, Buffalo, New York. (Preliminary Draft)

U. S. Fish and Wildlife Service. 1979a. Habitat evaluation procedures. U. S. Department of the Interior, Fish and Wildlife Service, Project Impact Evaluation Team, Fort Collins, Colorado. 66pp. + appendices. (Draft)

U. S. Fish and Wildlife Service. 1979b. A species characterization handbook for habitat evaluation - Tonawanda Creek flood control. U. S. Department of the Interior, Fish and Wildlife Service, Division of Ecological Services, Cortland, New York. 77pp. (Revised)

Whitlow, Thomas H., and Richard W. Harris. 1979. Flood tolerance in plants: a state-of-the-art review. U. S. Department of the Army, Engineering Division, Waterways Experiment Station Technical Report E-79-2. 161pp. + appendices.

Wilson, James A., and Roger Q. Landers. 1973. Plant species as wildlife cover and erosion control on "mudflats" in Iowa's large reservoir systems. Iowa State Water Resources Institute Publication No. 51. 10pp. + 32 figures.

Table 1. -- Fish species determined to be present in Tonawanda Creek and associated waters in the vicinity of the Towns of Alexander, Batavia, and Bethany, New York. A plus sign (+) denotes the observed presence of a species in a particular area or habitat type. Data are taken from unpublished fisheries survey reports provided by the State University of New York at Buffalo (left column) and Bio Systems Research, Inc., Buffalo, New York (right column; enclosed by parentheses).

| | Tonawanda Creek[1] (upper) | Tonawanda Creek[2] (lower) | Little Tonawanda Creek | Other Tributary | Oxbow or Pond |
|---|---|---|---|---|---|
| Brown Trout | (-) | -(-) | -(+) | -(-) | -(-) |
| White Sucker | (+) | +(+) | +(+) | +(+) | -(+) |
| Northern Hog Sucker | (+) | +(+) | +(+) | +(-) | -(-) |
| Carp | (-) | -(-) | -(-) | -(-) | -(+) |
| Stoneroller | (+) | -(+) | +(+) | +(+) | -(-) |
| Blacknose Dace | (+) | -(-) | +(+) | +(+) | -(+) |
| Creek Chub | (+) | -(-) | +(+) | +(+) | -(+) |
| Hornyhead Chub | (+) | -(+) | +(+) | +(-) | -(-) |
| Fallfish | (+) | -(+) | +(+) | +(+) | -(+) |
| Golden Shiner | (+) | +(-) | -(-) | -(+) | +(+) |
| Bluntnose Minnow | (+) | -(+) | +(+) | +(+) | -(+) |
| Fathead Minnow | (-) | -(-) | -(-) | +(+) | -(+) |
| Common Shiner | (+) | -(+) | +(+) | +(+) | +(+) |
| River Shiner | (-) | -(-) | +(-) | -(-) | -(-) |
| Sand Shiner | (+) | -(-) | +(-) | -(-) | -(-) |
| Brown Bullhead | (+) | +(+) | +(-) | -(-) | -(+) |
| Central Mudminnow | (-) | -(-) | -(-) | -(-) | -(+) |
| Northern Pike | (+) | -(+) | -(+) | +(-) | -(+) |
| Yellow Perch | (+) | -(-) | -(-) | -(-) | +(+) |
| Logperch | (+) | -(+) | -(-) | -(-) | -(-) |
| Johnny Darter | (+) | -(+) | +(+) | +(+) | -(+) |
| Iowa Darter | (-) | -(-) | +(-) | -(-) | -(-) |
| Fantail Darter | (-) | -(-) | +(+) | +(+) | -(-) |
| Smallmouth Bass | (+) | +(+) | +(+) | -(-) | -(-) |
| Largemouth Bass | (+) | -(-) | -(-) | -(-) | +(-) |
| Green Sunfish | (-) | -(-) | -(+) | -(+) | -(+) |
| Pumpkinseed | (+) | +(-) | +(+) | +(-) | +(+) |
| Bluegill | (-) | -(-) | +(-) | +(-) | +(+) |
| Rock Bass | (+) | +(+) | +(+) | -(+) | +(+) |

[1]Includes sampling conducted in the main channel between N.Y. Route 20 and Dorman Road. This area not sampled by SUNY-Buffalo.

[2]Includes sampling conducted in the main channel from the vicinity of Dorman Road to Main Street in the City of Batavia.

Table 2. -- Amphibians, reptiles, birds, and mammals and their associated habitats in the proposed Batavia Reservoir Compound and vicinity, Towns of Alexander and Batavia, New York. Data are summarized from field reconnaissance conducted between March 28 and July 13, 1979.

| Species | Habitat | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Tonawanda Creek | Tributary Stream | Pond or Wet Ditch | Emergent Marsh | Shrub Swamp | Forested Wetland | Riparian Hardwood | Railroad Right-of-Way | Hayfield or Pasture | Cropland | Residential |
| Amphibians | | | | | | | | | | | |
| Wood Frog | | | X | | X | X | | | | X | |
| Northern Leopard Frog | | X | X | X | X | | | | | | |
| Bullfrog | | X | X | X | | | X | | | | |
| Green Frog | | X | X | X | X | X | X | X | X | | |
| Gray Tree Frog | | | | X | X | X | | | | | |
| Spring Peeper | | | | X | X | X | | | | | |
| Western Chorus Frog | | | | X | | | | | | | |
| American Toad | X | | | X | X | X | X | X | X | X | |
| Blue-spotted Salamander | | | X | | | X | | X | | | |
| Jefferson's Salamander | | | | | | | | X | | | |
| Reptiles | | | | | | | | | | | |
| Eastern Milk Snake | | | | | | | | | | | X |
| Northern Water Snake | | | X | X | | | | X | | | |
| Eastern Garter Snake | | X | | | | X | X | X | X | | X |
| Northern Ribbon Snake | | | | | | | | X | X | | |
| Northern Brown Snake | | | | | | | | X | X | | |
| Northern Red-bellied Snake | | | | | | | | X | X | | |
| Common Snapping Turtle | | | X | X | X | X | X | X | X | | |
| Midland Painted Turtle | | | X | X | | X | | X | | X | |
| Wood Turtle | | | | | | | | X | | | |
| Birds | | | | | | | | | | | |
| Great Blue Heron* | | | X | X | | X | X | | X | | |
| Great Egret* | | | | X | | | | | | | |
| Green Heron | | | X | X | X | X | | X | | | |
| American Bittern | | | | | | | | | X | | |
| Canada Goose | X | | X | X | | X | | | X | | X |
| Wood Duck | | | | X | | X | X | | | | |
| Mallard | X | X | | X | X | X | X | | X | X | X |

Table 2 (Continued).

| Species | Tonawanda Creek | Tributary Stream | Pond or Wet Ditch | Emergent Marsh | Shrub Swamp | Forested Wetland | Riparian Hardwood | Railroad Right-of-Way | Hayfield or Pasture | Cropland | Residential |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Habitat | | | | | | | | | | |
| American Widgeon* | | | | X | | X | | | | | |
| Blue Winged Teal | | | X | X | | | | | | | |
| Turkey Vulture | | | | | | X | | | X | X | |
| Red-tailed Hawk | | | | | | X | X | | X | | |
| Marsh Hawk** | | | | | | | | | X | | |
| American Kestrel | | | | | X | | | | X | X | |
| Ring-necked Pheasant | | | | | | | | | | X | X |
| Wild Turkey | | | | | | X | | | | | |
| Common Gallinule | | | | X | | | | | | | |
| Killdeer | X | | | X | | | X | X | X | X | X |
| American Woodcock | | | | | | X | | X | | | |
| Common Snipe | | | | X | | | | | X | | |
| Greater Yellowlegs** | | | | X | | | | | | X | |
| Spotted Sandpiper** | X | | X | X | | | X | | | | |
| Herring Gull** | | | | | | | | | X | | |
| Black Tern** | | | | X | | | | | | | |
| Rock Dove | | | | | | | X | | X | X | X |
| Mourning Dove | | | | | X | X | X | X | X | X | X |
| Black-billed Cuckoo | | | | | X | | | X | | | X |
| Great Horned Owl | | | | | | | X | | | | |
| Common Nighthawk | | | | | | | | | | | X |
| Chimney Swift | | | | | | | | | X | X | X |
| Belted Kingfisher | | | X | X | | X | X | | X | | |
| Common Flicker | | | | X | X | X | X | x | X | | X |
| Red-bellied Woodpecker | | | | | | X | | | | | |
| Red-headed Woodpecker | | | | | | X | X | | | | X |
| Hairy Woodpecker | | | | | | X | X | | | | |
| Downy Woodpecker | | | | | | | X | | | | |
| Eastern Kingbird | | | | X | X | | | | X | X | |
| Great Crested Flycatcher | | | | | | X | X | | | | |
| Eastern Phoebe | | | | | X | X | | X | | | |
| Least Flycatcher | | | | | | X | X | | | | |
| Eastern Wood Pewee | | | | | | X | X | X | | | |
| Horned Lark | | | | | | | | | X | X | |
| Tree Swallow | | | | X | | | | | | | |
| Barn Swallow | | | X | X | | X | X | | X | X | X |

Table 2 (Continued).

| Species | Tonawanda Creek | Tributary Stream | Pond or Wet Ditch | Emergent Marsh | Shrub Swamp | Forested Wetland | Riparian Hardwood | Railroad Right-of-Way | Hayfield or Pasture | Cropland | Residential |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Habitat | | | | | |
| Blue Jay | | | | | X | X | X | | X | | X |
| American Crow | | | | | | X | X | X | X | X | |
| Black-capped Chickadee | | | | | X | X | X | | | | |
| White-breasted Nuthatch | | | | | X | X | X | | | | |
| House Wren | | | | | | X | X | | | | |
| Gray Catbird | | | | X | X | X | X | X | | | |
| Brown Thrasher** | | | | | | X | | | | | |
| American Robin | | | | | X | X | X | X | X | X | X |
| Wood Thrush | | | | | | X | X | X | | | |
| Veery | | | | | X | X | | | | | |
| Cedar Waxwing | | | | | X | | X | X | | | |
| Red-eyed Vireo | | | | | | X | X | | | | |
| Warbling Vireo | | | | | | X | X | | | | |
| Yellow Warbler | | | | | X | X | X | X | | | X |
| Common Yellowthroat | | | | X | X | X | X | X | | | |
| Yellow-rumped Warbler** | | | | | | X | | | | | |
| Blue-winged Warbler** | | | | | | X | | | | | |
| Bobolink | | | | X | | | | | X | | |
| Eastern Meadowlark | | | | | | | | | X | | |
| Red-winged Blackbird | | | | X | X | X | X | X | X | X | X |
| Northern Oriole | | | | | | X | X | X | | | |
| Common Grackle | | | | X | X | X | X | | X | X | X |
| Brown-headed Cowbird | | | | | X | X | X | | | X | X |
| Rusty Blackbird** | | | | | | X | | | | | |
| Common Starling | | | | | | | | | | | X |
| House Sparrow | | | | | | | | | | X | X |
| Scarlet Tanager | | | | | | X | X | | | | |
| Common Cardinal | | | | | X | X | X | X | | | X |
| Rose-breasted Grosbeak | | | | | | X | X | X | | | |
| Indigo Bunting | | | | | | X | X | | | | |
| American Goldfinch | | | | | X | X | X | X | X | X | |
| Rufous-sided Towhee** | | | | | | | X | | | | |
| Savannah Sparrow | | | | | | | | | X | X | |
| Henslow's Sparrow | | | | X | | | | | | | |
| Vesper Sparrow | | | | | | | | | X | X | |
| Chipping Sparrow | | | | | X | | | | | | X |

Table 2 (Continued).

| | Habitat | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Species | Tonawanda Creek | Tributary Stream | Pond or Wet Ditch | Emergent Marsh | Shrub Swamp | Forested Wetland | Riparian Hardwood | Railroad Right-of-Way | Hayfield or Pasture | Cropland | Residential |
| Field Sparrow | | | | | X | | X | | X | | |
| Slate-colored Junco** | | | | | | | | | | | |
| White-throated Sparrow** | | | | | X | | X | X | | | |
| Swamp Sparrow | | | | X | X | | | | | | |
| Song Sparrow | | | | | X | X | X | X | | X | |
| House Finch | | | | | | | | | | | X |
| <u>Mammals</u> | | | | | | | | | | | |
| Opossum | X | | | | | X | | | X | X | |
| Masked Shrew | | | | | | | X | | | | |
| Short-tailed Shrew | | | X | X | X | | X | X | X | | |
| Eastern Cottontail Rabbit | | | | | X | X | | X | | | |
| Eastern Chipmunk | | | | | X | X | X | X | | X | X |
| Woodchuck | | | | | X | X | X | X | X | | |
| Eastern Gray Squirrel | | | | | | X | | X | | | X |
| Red Squirrel | | | | | | X | | | | | X |
| Deer Mouse | | | | | | X | X | | | | |
| White-footed Mouse | | | | | | X | | | | | |
| Muskrat | | X | X | X | X | | | X | | | |
| Meadow Jumping Mouse | | | | | | | X | | | | |
| Raccoon | X | | X | | | X | X | | X | | |
| Mink | | | | | | | X | | | | |
| Striped Skunk | | | | | X | X | X | | X | X | |
| White-tailed Deer | X | | X | X | X | X | X | X | X | X | |

* Non-breeding spring resident.
** Spring migrant.

Table 3. -- Results of 1979 breeding bird censuses taken along stands of riparian growth on Tonawanda Creek, Towns of Alexander and Batavia, New York. Numbers indicate counts of singing birds.

| | Dates/Transect #1[a] | | | Dates/Transect #2[b] | | |
|---|---|---|---|---|---|---|
| Species | 6-6-79 | 6-27-79 | 7-11-79 | 6-6-79 | 6-27-79 | 7-11-79 |
| Yellow Warbler | 17 | 10 | 9 | 11 | 12 | 4 |
| Red-winged Blackbird | 10 | 7 | 7 | 0 | 2 | 1 |
| Song Sparrow | 8 | 10 | 12 | 3 | 10 | 9 |
| House Wren | 6 | 5 | 7 | 6 | 7 | 6 |
| American Robin | 5 | 6 | 8 | 5 | 4 | 3 |
| Brown-headed Cowbird | 0 | 0 | 3 | 4 | 4 | 4 |
| Gray Catbird | 2 | 4 | 3 | 1 | 2 | 4 |
| Common Cardinal | 2 | 0 | 1 | 0 | 1 | 0 |
| Rose-breasted Grosbeak | 2 | 0 | 1 | 0 | 0 | 0 |
| Eastern Wood Pewee | 0 | 2 | 2 | 1 | 0 | 1 |
| Least Flycatcher | 1 | 0 | 2 | 2 | 0 | 1 |
| Red-headed Woodpecker | 0 | 0 | 0 | 2 | 0 | 0 |
| White-breasted Nuthatch | 1 | 0 | 1 | 0 | 0 | 2 |
| American Goldfinch | 1 | 1 | 3 | 0 | 1 | 3 |
| Common Grackle | 1 | 1 | 0 | 0 | 0 | 0 |
| Spotted Sandpiper | 0 | 1 | 0 | 1 | 1 | 0 |
| Mourning Dove | 1 | 1 | 0 | 0 | 0 | 0 |
| Great Crested Flycatcher | 1 | 0 | 0 | 0 | 0 | 0 |
| Wood Thrush | 1 | 0 | 0 | 0 | 0 | 0 |
| Mallard | 1 | 0 | 0 | 0 | 0 | 0 |
| Warbling Vireo | 0 | 1 | 1 | 0 | 0 | 0 |
| Northern Oriole | 0 | 1 | 0 | 0 | 1 | 0 |
| Downy Woodpecker | 0 | 1 | 0 | 0 | 0 | 0 |
| Belted Kingfisher | 0 | 0 | 1 | 0 | 0 | 0 |
| Red-eyed Vireo | 0 | 0 | 1 | 0 | 0 | 0 |
| Common Yellowthroat | 0 | 0 | 1 | 0 | 0 | 0 |
| Indigo Bunting | 0 | 0 | 0 | 0 | 0 | 1 |

[a] Transect #1 ran 1,295 meters north along Tonawanda Creek from Peaviner Road.

[b] Transect #2 ran 1,029 meters northeast along Tonawanda Creek from where the creek intersects the Erie Railroad embankment.

Table 4. -- Evaluation elements (species) used to evaluate wildlife habitat in the area of the proposed Tonawanda Creek Flood Control Project, Towns of Alexander and Batavia, New York.

| Evaluation Element (Species) | | Habitat Types: Emergent Marsh | Shrub Swamp | Forested Wetland | Pasture | Cropland |
|---|---|---|---|---|---|---|
| **Amphibians** | | | | | | |
| Wood Frog (*Rana sylvatica*) | | | | X | | |
| Blue-spotted Salamander (*Ambystoma laterale*) | | | | X | | |
| **Reptiles** | | | | | | |
| Eastern Garter Snake (*Thamnophis sirtalis*) | | | | | | X |
| **Birds** | | | | | | |
| Indigo Bunting (*Passerina cyanea*) | | | X | | | |
| Eastern Meadowlark (*Sturnella magna*) | | | | | X | |
| Red-winged Blackbird (*Agelaius phoeniceus*) | | X | | | | |
| Horned Lark (*Eremophila alpestris*) | | | | | | X |
| Spotted Sandpiper (*Actitis macularia*) | | X | | | | |
| Belted Kingfisher (*Megaceryle alcyon*) | | | | X | | |
| Kestrel (*Falco sparverius*) | | | | | X | X |
| **Mammals** | | | | | | |
| Meadow Vole (*Microtus pennsylvanicus*) | | X | X | | | |
| Eastern Cottontail Rabbit (*Sylvilagus floridanus*) | | | X | | | |
| Red Fox (*Vulpes vulpes*) | | | | | X | |
| White-tailed Deer (*Odocoileus Virginianus*) | | | X | X | X | X |
| Total Species | 14 | 3 | 4 | 4 | 4 | 4 |

Table 5. -- Inventory characteristics used to evaluate wildlife habitat in the area of the proposed Tonawanda Creek Flood Control Project, Towns of Alexander and Batavia, New York.

| | Habitat Types | | | | |
|---|---|---|---|---|---|
| Inventory Characteristics | Emergent Marsh | Shrub Swamp | Forested Wetland | Pasture | Cropland |
| % Herbaceous Ground Cover | X | X | | X | X |
| % Shrub Crown Cover | | X | | X | |
| % Tree Canopy Closure | | | X | | |
| Composition of Vegetation | X | X | | X | |
| Type of Rowcrop | | | | | X |
| No. of Browse Species Present/Acre | | | X | | |
| Av. Height of Herbaceous Vegetation | X | X | | X | X |
| Av. Height of Shrubs | | X | | | |
| Av. Height of Trees | | | X | | |
| % Treeland within 1Km Radius | | | | | X |
| Distance to Woodland or Brushy Cover | | X | | X | X |
| Distance to Cutbanks for Nesting | | | X | | |
| Distance to Feeding Area | | | X | | |
| Distance to Water | X | X | | X | X |
| Abundance of Water Bodies | | | X | | |
| Water Depth | X | | X | | |
| Abundance of Dead Logs, Stumps, Etc. | | | X | | |
| Depth of Leaf Litter | | | X | | |
| % Forest Floor Covered by Leaf Litter | | | X | | |
| % Pool Bottom Covered by Plant Debris | | | X | | |
| Soil Type | | | | X | |
| Relative Soil Moisture | X | X | X | | X |
| Consecutive Days of Snow Cover | | | | X | X |
| Abundance of Perch Sites | | X | X | X | X |
| Abundance of Nest Cavities or Boxes | | | | X | X |

Table 6. -- Summary of baseline habitat conditions in the area of the proposed Tonawanda Creek Flood Control Project, Towns of Alexander and Batavia, New York.

| Habitat Type | HSI[1] | Habitat Units[2] (Number of Hectares) | | |
|---|---|---|---|---|
| | | Upper Pool | Lower Pool | Total |
| Emergent Marsh (EM) | 0.664 | 29.0(43.7) | 23.9(36.0) | 52.9(79.7) |
| Shrub Swamp (SS) | 0.750 | 38.0(50.6) | 96.9(129.2) | 134.9(179.8) |
| Forested Wetland (FO) | 0.803 | 63.7(79.4) | 295.0(367.3) | 358.7(446.7) |
| Pasture (P) | 0.754 | 28.1(37.3) | 98.6(130.8) | 126.7(168.1) |
| Cropland (C)[3] | 0.605 | 75.5(124.7) | 256.8(424.4) | 332.3(549.1) |
| Total | ----- | 234.3(335.7) | 771.2(1087.7) | 1005.5(1423.4) |

[1]Habitat Suitability Index.

[2]Habitat Unit=HSIX hectares.

[3]Includes hayfields.

Table 7. -- Estimated loss of Habitat Units due to the construction of dry dams and lateral dikes for the proposed Tonawanda Creek Flood Control Project, Towns of Alexander and Batavia, New York.

| | Habitat Units (Number of Hectares) | | | | | |
|---|---|---|---|---|---|---|
| Flood Management Structures | Emergent Marsh | Shrub Swamp | Forested Wetland | Pasture | Cropland | Totals |
| Lower Dam | 0.0(0.0) | -1.3(1.7) | -1.2(0.3) | 0.0(0.0) | -3.0(5.0) | -4.5(6.9) |
| Upper Dam | -0.7(1.0) | 0.0(0.0) | -0.3(0.4) | 0.0(0.0) | -2.2(3.6) | -3.2(5.0) |
| Lateral Dikes | 0.0(0.0) | -0.1(0.1) | -0.1(0.2) | 0.0(0.0) | -1.4(2.3) | -2.6(2.6) |
| Totals | -0.7(1.0) | -1.4(1.8) | -0.7(0.8) | 0.0(0.0) | -6.5(10.8) | -9.2(14.4) |

Table 8. -- Annualized Habitat Unit changes for without-the-project conditions and within the flood pool boundaries of the proposed Tonawanda Creek Flood Control Project, Towns of Alexander and Batavia, New York.

| | | Upper Reservoir Pool | | | Lower Reservoir Pool | | | |
|---|---|---|---|---|---|---|---|---|
| Habitat Type (HSI)[1] | Target Year | Hectares | Habitat Units | Annualized Habitat Unit Change | Hectares | Habitat Units | Annualized Habitat Unit Change | Total Annualized Habitat Unit Change |
| Emergent Marsh | | | | | | | | |
| (0.664) | 0 | 43.7 | 29.0 | | 36.0 | 23.9 | 0.0 | 0.0 |
| | 25 | 43.7 | 29.0 | | 36.0 | 23.9 | | |
| | 50 | 43.7 | 29.0 | | 36.0 | 23.9 | | |
| | 75 | 43.7 | 29.0 | | 36.0 | 23.9 | | |
| | 100 | 43.7 | 29.0 | 0.0 | 36.0 | 23.9 | 0.0 | 0.0 |
| Shrub Swamp | | | | | | | | |
| (0.750) | 0 | 50.6 | 38.0 | | 129.2 | 96.9 | | |
| | 25 | 43.4 | 32.5 | | 106.6 | 79.9 | | |
| | 50 | 36.3 | 27.2 | | 84.1 | 63.1 | | |
| | 75 | 29.1 | 21.8 | | 61.5 | 46.1 | | |
| | 100 | 22.0 | 16.5 | -27.2 | 38.9 | 29.2 | -63.0 | -90.2 |
| Forested Wetland | | | | | | | | |
| (0.803) | 0 | 79.4 | 63.7 | | 367.3 | 295.0 | | |
| | 25 | 88.9 | 71.4 | | 393.1 | 315.7 | | |
| | 50 | 98.4 | 79.0 | | 419.0 | 336.5 | | |
| | 75 | 107.9 | 86.6 | | 444.8 | 357.2 | | |
| | 100 | 117.3 | 94.2 | +79.0 | 470.7 | 378.0 | +337.2 | +416.2 |
| Pasture | | | | | | | | |
| (0.754) | 0 | 37.3 | 28.1 | | 130.8 | 98.6 | | |
| | 25 | 35.0 | 26.4 | | 127.5 | 96.1 | | |
| | 50 | 32.6 | 24.6 | | 124.3 | 93.7 | | |
| | 75 | 30.3 | 22.8 | | 121.0 | 91.2 | | |
| | 100 | 28.0 | 21.1 | -24.6 | 117.7 | 88.7 | -93.7 | -118.3 |
| Cropland | | | | | | | | |
| (0.605) | 0 | 124.7 | 75.5 | | 424.4 | 256.8 | | |
| | 25 | 124.7 | 75.5 | | 424.4 | 256.8 | | |
| | 50 | 124.7 | 75.5 | | 424.4 | 256.8 | | |
| | 75 | 124.7 | 75.5 | | 424.4 | 256.8 | | |
| | 100 | 124.7 | 75.5 | 0.0 | 424.4 | 256.8 | 0.0 | 0.0 |
| Total Annualized Habitat Unit Change | | | | +27.2 | | | +180.5 | +207.7 |

[1]Habitat Suitability Index.

Table 9. -- Annualized Habitat Unit changes for with-the-project conditions and within the flood pool boundaries of the proposed Tonawanda Creek Flood Control Project, Towns of Alexander and Batavia, New York.

| Habitat Type (HSI)[1] | Target Year | Upper Reservoir Pool Hectares | Upper Reservoir Pool Habitat Units | Upper Reservoir Pool Annualized Habitat Unit Change | Lower Reservoir Pool Hectares | Lower Reservoir Pool Habitat Units | Lower Reservoir Pool Annualized Habitat Unit Change | Total Annualized Habitat Unit Change |
|---|---|---|---|---|---|---|---|---|
| Emergent Marsh | | | | | | | | |
| (0.664) | 0 | 43.7 | 29.0 | | 36.0 | 23.9 | | |
| | 25 | 44.1 | 29.3 | | 48.5 | 32.2 | | |
| | 50 | 59.8 | 39.7 | | 60.9 | 40.4 | | |
| | 75 | 75.5 | 50.1 | | 73.4 | 48.7 | | |
| | 100 | 91.2 | 60.6 | +41.0 | 85.8 | 57.0 | +40.5 | +81.5 |
| Shrub Swamp | | | | | | | | |
| (0.750) | 0 | 50.6 | 38.0 | | 129.2 | 96.9 | | |
| | 25 | 32.0 | 24.0 | | 121.3 | 91.0 | | |
| | 50 | 31.0 | 23.2 | | 120.0 | 90.0 | | |
| | 75 | 30.1 | 22.6 | | 118.6 | 88.9 | | |
| | 100 | 29.2 | 21.8 | -24.9 | 117.3 | 88.0 | -90.6 | -115.5 |
| Forested Wetland | | | | | | | | |
| (0.803) | 0 | 79.4 | 63.7 | | 367.3 | 295.0 | | |
| | 25 | 54.0 | 43.4 | | 365.6 | 293.6 | | |
| | 50 | 56.3 | 45.2 | | 382.2 | 306.9 | | |
| | 75 | 58.7 | 47.1 | | 398.9 | 320.3 | | |
| | 100 | 61.0 | 49.0 | -48.0 | 415.5 | 333.7 | +308.8 | +260.8 |
| Pasture | | | | | | | | |
| (0.754) | 0 | 37.3 | 28.1 | | 130.8 | 98.6 | | |
| | 25 | 19.6 | 14.8 | | 117.0 | 88.2 | | |
| | 50 | 14.9 | 11.2 | | 110.4 | 83.2 | | |
| | 75 | 10.3 | 7.8 | | 103.9 | 78.3 | | |
| | 100 | 5.6 | 4.2 | -12.5 | 97.3 | 73.4 | -83.9 | -96.4 |
| Cropland | | | | | | | | |
| (0.605) | 0 | 124.7 | 75.5 | | 424.4 | 256.8 | | |
| | 25 | 37.4 | 22.6 | | 382.0 | 231.1 | | |
| | 50 | 24.9 | 18.8 | | 360.7 | 218.2 | | |
| | 75 | 12.5 | 9.4 | | 339.5 | 205.4 | | |
| | 100 | 0.0 | 0.0 | -20.7 | 318.3 | 192.6 | -219.8 | -240.5 |
| Total Annualized Habitat Unit Change | | | | -65.1 | | | -45.0 | -110.1 |

[1]Habitat Suitability Index.

Table 10. -- Average annual change in Habitat Units within the flood pool boundaries of the proposed Tonawanda Creek Flood Control Project, Towns of Alexander and Batavia, New York, and area required for in-kind compensation of Habitat Unit losses.

| Habitat Types | Average Annual Change in Habitat Units[1] Without the Project | With the Project | Net Average[2] Annual Change HU's | Area Required for Compensation (Hectares) |
|---|---|---|---|---|
| Emergent Marsh | 0.0 | +81.5 | +81.5 | 0.0 |
| Shrub Swamp | -90.2 | -115.5 | +25.3 | 33.7 |
| Forested Wetland | +416.2 | +260.8 | -155.4 | 193.5 |
| Pasture | -118.3 | -96.4 | +21.9 | 0.0 |
| Cropland | 0.0 | -240.5 | -240.5 | 397.5 |
| Total | +207.7 | -110.1 | -317.8 | 624.7 |

[1]Average annual change in Habitat Units from Tables 8 and 9.

[2]Does not include Habitat Units lost due to the construction of the dry dams and lateral dikes (Table 7).

Table 11. -- Relative Importance Value Criteria determined for each habitat type in the area of the proposed Tonawanda Creek Flood Control Project, Towns of Alexander and Batavia, Genesee County, New York.

| RIV Criteria | Range of Value[1] | Habitat Type | | | | |
|---|---|---|---|---|---|---|
| | | Emergent Marsh | Shrub Swamp | Forested Wetland | Pasture | Cropland |
| Abundance | 1-most abundant<br>10-least abundant | 10 | 8 | 3 | 8 | 1 |
| Vulnerability | 1-lowest probability<br>10-greatest probability | 6 | 1 | 1 | 9 | 10 |
| Replaceability | 1-easily managed and/or created<br>10-little or no possibility to manage or create | 5 | 8 | 10 | 2 | 1 |
| Aesthetic Value | 1-lowest value<br>10-highest value | 9 | 5 | 10 | 3 | 1 |
| Recreational Diversity | 1-low<br>10-high | 10 | 7 | 10 | 2 | 2 |
| Species Richness | 1-lowest<br>10-highest | 7 | 8 | 10 | 3 | 1 |

[1]A scale of 1-10 was used for filling each square of this matrix.

Table 12. --Pairwise comparison of Relative Importance Value Criteria, and weighting factors used in the development of Relative Importance Values.

| RIV Criteria | Pairwise Comparisons[1] | | | | | | | | | | | | | | | | | | | | | Sum | Weight[2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Abundance | 1 | 1 | 1 | 0 | 0 | 1 | | | | | | | | | | | | | | | | 4 | 0.19 |
| Vulnerability | 0 | | | | | | 1 | 1 | 1 | 0 | 1 | | | | | | | | | | | 4 | 0.19 |
| Replaceability | | 0 | | | | | 0 | | | | | 1 | 1 | 0 | 1 | | | | | | | 3 | 0.14 |
| Aesthetic Value | | | 0 | | | | | 0 | | | | 0 | | | | 0 | 0 | 1 | | | | 1 | 0.05 |
| Recreational Diversity | | | | 1 | | | | | 0 | | | | 0 | | | 1 | | | 0 | 1 | | 3 | 0.14 |
| Species Richness | | | | | 1 | | | | | 1 | | | | 1 | | | 1 | | 1 | | 1 | 6 | 0.29 |
| Dummy Variables | | | | | | 0 | | | | | 0 | | | | 0 | | | 0 | | 0 | 0 | 0 | 0.00 |
| Total | | | | | | | | | | | | | | | | | | | | | | 21 | 1.00 |

[1]This technique requires that each criterion be compared to every other criterion, and a decision made as to which criterion of any pair is the most significant. A dummy criterion is included to insure that all criteria will have some weighting value.

[2]The sum total is divided into each criterion sum and the resulting value entered in the weight column representing the relative importance of each criterion.

Table 13. -- Relative Importance Values determined for each habitat type in the area of the proposed Tonawanda Creek Flood Control Project, Towns of Alexander and Batavia, Genesee County, New York.

| RIV Criteria | Habitat Types | | | | |
|---|---|---|---|---|---|
| | Emergent Marsh | Shrub Swamp | Forested Wetland | Pasture | Cropland |
| Abundance | 1.90[1] | 1.52 | 0.57 | 1.52 | 0.19 |
| Vulnerability | 1.14 | 0.19 | 0.19 | 1.71 | 1.90 |
| Replaceability | 0.70 | 1.12 | 1.40 | 0.28 | 0.14 |
| Aesthetic Value | 0.45 | 0.25 | 0.50 | 0.15 | 0.05 |
| Recreational Diversity | 1.40 | 0.98 | 1.40 | 0.28 | 0.28 |
| Species Richness | 2.03 | 2.32 | 2.90 | 0.87 | 0.29 |
| Total | 7.62 | 6.38 | 6.96 | 4.81 | 2.85 |
| Relative Importance Value (RIV)[2] | 1.00 | 0.84 | 0.91 | 0.63 | 0.37 |

[1]Represents the product of the values from Tables 11 and 12.

[2]The Relative Importance Value is obtained by dividing the sum for each habitat type by the greatest individual sum.

Table 14. -- Adjustment of Habitat Unit losses and gains using Relative Importance Values, and areas required for compensation of Habitat Unit losses expected from the construction and operation of the Tonawanda Creek Flood Control Project, Town of Alexander and Batavia, Genesee County, New York.

| Habitat Type | RIV[1] | Net Gain or loss of HU's[2] | RIV Habitat Type 1 / RIV Habitat Type 2 | | HU's Type 2 / HV's Type 1 | X HU's | Adjusted HU's | Area Required for compensation (Hectares) |
|---|---|---|---|---|---|---|---|---|
| Pasture (A) | 0.63 | +21.9 | | | | -21.9 | 0.0 | 0.0 |
| Cropland (B) | 0.37 | -247.0 | $\frac{0.63(A)}{0.37(B)}$ | = | $\frac{X(B)}{21.9(A)}$ | +37.3 | -209.7 | --- |
| Emergent Marsh (C) | 1.00 | +80.8 | | | | -80.8 | 0.0 | 0.0 |
| Cropland (B1) | 0.37 | -209.7 | $\frac{1.00(C)}{0.37(B1)}$ | = | $\frac{X(B1)}{80.8(C)}$ | +218.4 | +8.7 | --- |
| Cropland (B2) | 0.37 | +4.3[3] | | | | -4.3 | 0.0 | 0.0 |
| Shrub Swamp (D) | 0.84 | -25.4 | $\frac{0.37(B2)}{0.84(D)}$ | = | $\frac{X(D)}{4.3(B2)}$ | +1.9 | -23.5 | 31.4 |
| Cropland (B3) | 0.37 | +4.3[3] | | | | -4.3 | 0.0 | 0.0 |
| Forested Wetland(E) | 0.91 | -156.1 | $\frac{0.37(B3)}{0.91(E)}$ | = | $\frac{X(E)}{4.3(B3)}$ | +1.7 | -154.4 | 192.3 |
| Total adjusted area required for compensation | | | | | | | | 223.7 |

[1]Relative Importance Values from Table 13.

[2]Includes Habitat Unit losses from the construction of dry dams and lateral dikes (Table 7).

[3]Habitat Unit losses in cropland habitat (B1) are distributed evenly among shrub swamp and forested wetland for compensation purposes.

Table 15. -- Estimated costs for the acquisition and the operation and maintenance of wildlife habitat needed (a) to compensate for Habitat Unit losses and (b) for the in-kind replacement of upper reservoir floodpool wetlands, Tonawanda Creek Flood Control Project, Towns of Alexander and Batavia, Genesee County, New York.

| Habitat Types | Number[1] of Hectares | Acquisitions Costs[2,3] | | Operation and Maintenance Costs[3,4] | |
|---|---|---|---|---|---|
| | | Cost/Hectare | Total Cost | Cost/Hectare | Total Cost |
| Emergent Marsh | 15.1 | $1,500 | $22,650 | $40 | $604 |
| Shrub Swamp | 61.6 | $1,500 | $92,400 | $40 | $2,464 |
| Forested Wetland | 192.3 | $1,500 | $288,450 | $40 | $7,692 |
| Pasture | 0.0 | ----- | ------- | --- | ------- |
| Cropland | 0.0 | ----- | ------- | --- | ------- |
| Totals | | | $403,500 | | $10,760 |

[1]Sum of areas shown in Table 14 and areas required for in-kind replacement of the 45.2 ha wetland complex in the upper-reservoir floodpool.

[2]Land acquisition costs estimated by the Corps of Engineers, Buffalo District, based on 1980 dollars.

[3]Field costs estimated by the New York State Department of Environmental Conservation and the U. S. Fish and Wildlife Service based on 1980 dollars.

[4]Annualized cost over period of analysis (100 years).

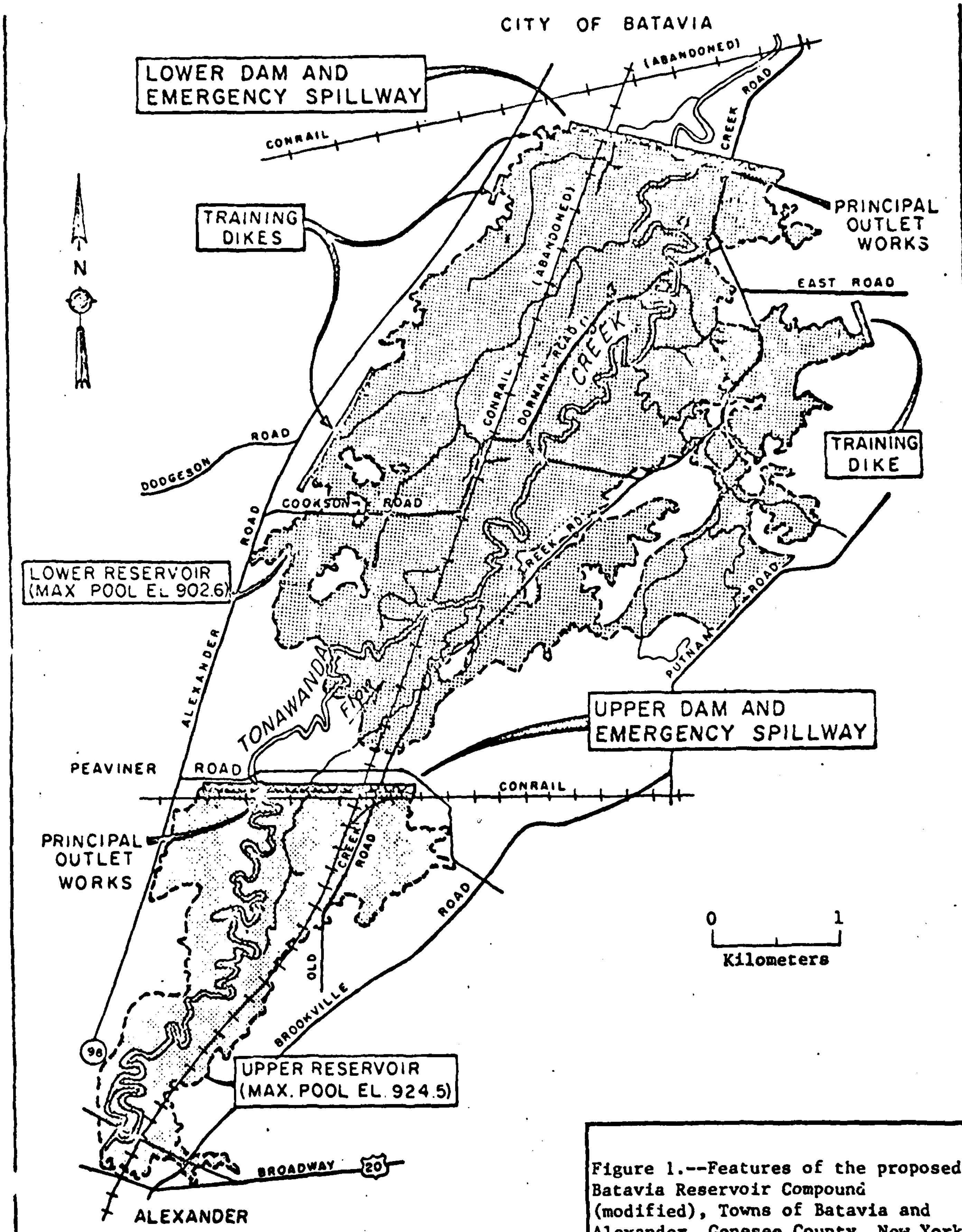



Figure 1.--Features of the proposed Batavia Reservoir Compound (modified), Towns of Batavia and Alexander, Genesee County, New York (adapted from U.S. Army Corps of Engineers, 1979).

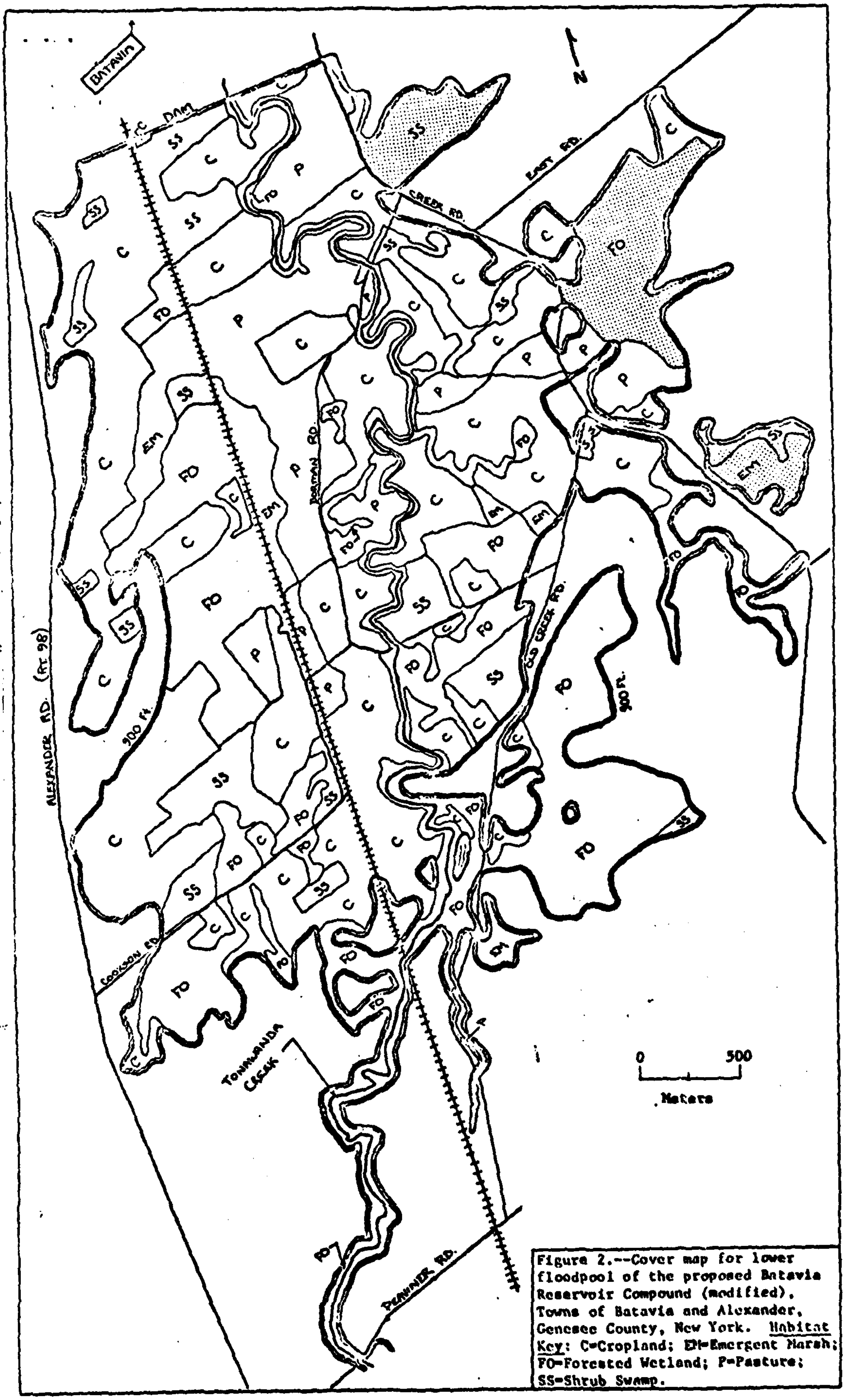



Figure 2.--Cover map for lower floodpool of the proposed Batavia Reservoir Compound (modified), Towns of Batavia and Alexander, Genesee County, New York. Habitat Key: C=Cropland; EM=Emergent Marsh; FO=Forested Wetland; P=Pasture; SS=Shrub Swamp.

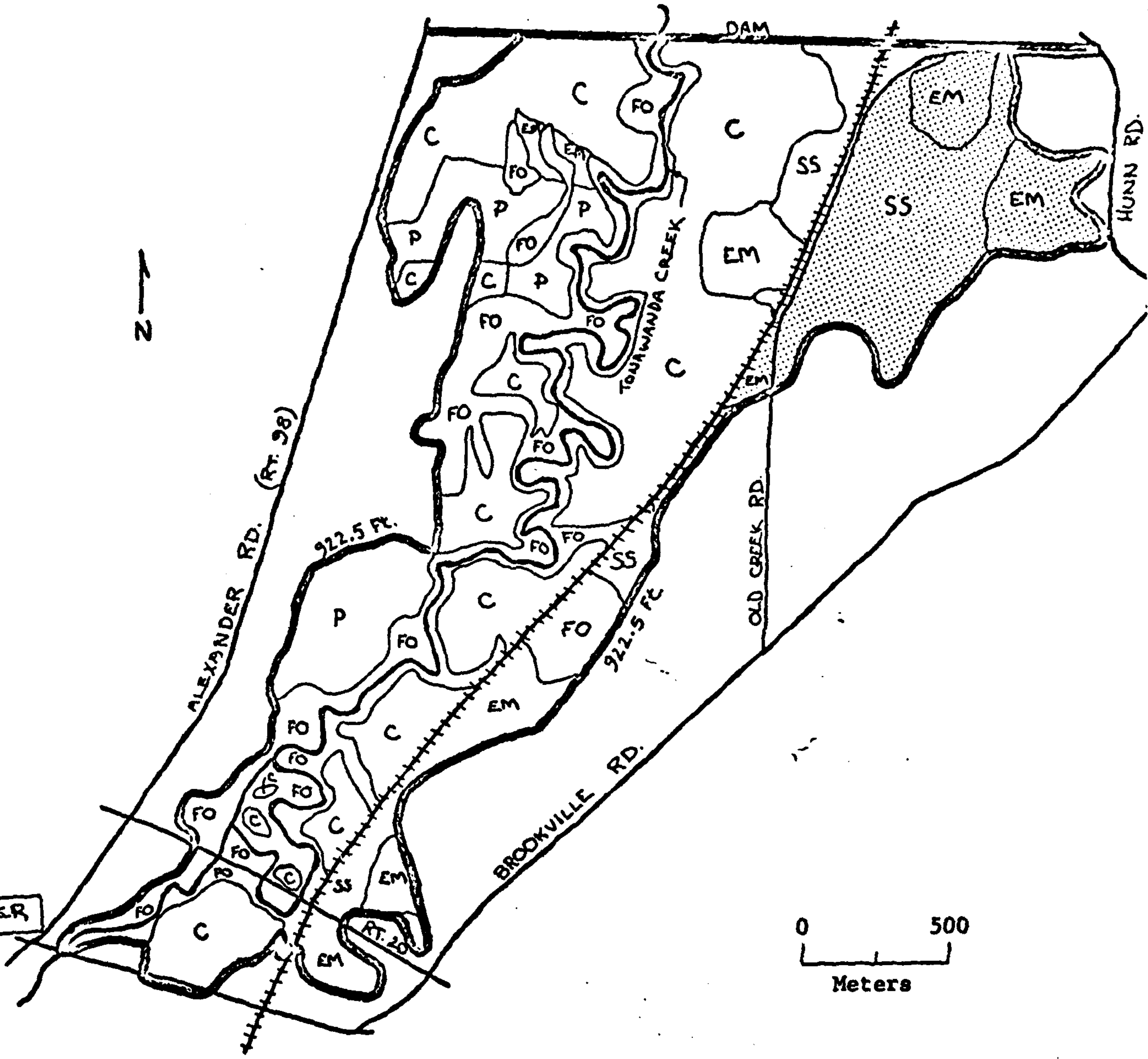



Figure 3.--Cover map for upper floodpool of the proposed Batavia Reservoir Compound (modified), Towns of Batavia and Alexander, Genesee County, New York. <u>Habitat Key</u>: C=Cropland; EM=Emergent Marsh; FO=Forested Wetland; P=Pasture; SS=Shrub Swamp.

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233

Robert F. Flacke
Commissioner

February 20, 1980

Mr. Paul P. Hamilton
Field Supervisor
United States Department of
the Interior
Fish and Wildlife Service
100 Grange Place, Room 202
Cortland, New York 13045

Dear Mr. Hamilton:

The Division of Fish and Wildlife is in general accord with the findings and recommendations of the report on the proposed flood control project along Tonawanda Creek in the towns of Batavia and Alexander, Genesee County, New York. But we do feel that instead of using the term "selective snagging", you should indicate that stumps embedded in the bank should be cut rather than pulled, and where they would not materially affect the roughness of the bottom, deeply embedded logs are to remain in the bottom. We also believe that instead of building a stairway or path traversing the dams, the Batavia-Alexander Recreational Trail should be re-routed around the structures.

Sincerely,

Kenneth Wich

Kennth F. Wich
Director
Division of Fish and Wildlife

cc: James Kelley

New York State Department of Environmental Conservation
6274 E. Avon-Lima Rd. Avon, New York 14414

Robert F. Flacke
Commissioner

Eric A. Seiffer
Regional Director

September 29, 1980

Mr. Paul B. Hamilton
Field Supervisor
United States Department of the Interior
Fish and Wildlife Service
100 Grange Place, Room 202
Cortland, New York 13045

Dear Mr. Hamilton:

The Division of Fish and Wildlife concurs with the findings and recommendations of the report on the Corps of Engineers Tonawanda Creek Flood Control Project, Towns of Batavia and Alexander, Genesee County, New York prepared under the authority of the Fish and Wildlife Coordination Act (16 USC 661).

We would also like to make some specific recommendations for sites to be considered as mitigation (see attached).

Site #1 - Shallow fresh marsh, deep fresh marsh, wood wetland, gets heavy use by waterfowl and heavy hunting pressure; great potential for enhancement with water control structures.

Sites #2 and #3 - High vulnerability to filling for industrial development, shallow fresh marsh, wooded swamp, has good potential for enhancement.

Sites #4 and 5 - Wooded swamp, low potential for enhancement.

Sites #7, 7 and 8 - Shallow fresh to deep fresh marsh, good potential for enhancement.

If you have any questions concerning these areas, please contact Jack Cooper or Dan Carroll at our Regional Office. Our continued coordination on this project should help to ensure an environmentally acceptable project.

Very truly yours,

Edward D. Holmes

Edward D. Holmes
Regional Supervisor
Fish & Wildlife
Region #8

Kenneth Wich

Kenneth Wich
Director
Division of Fish & Wildlife

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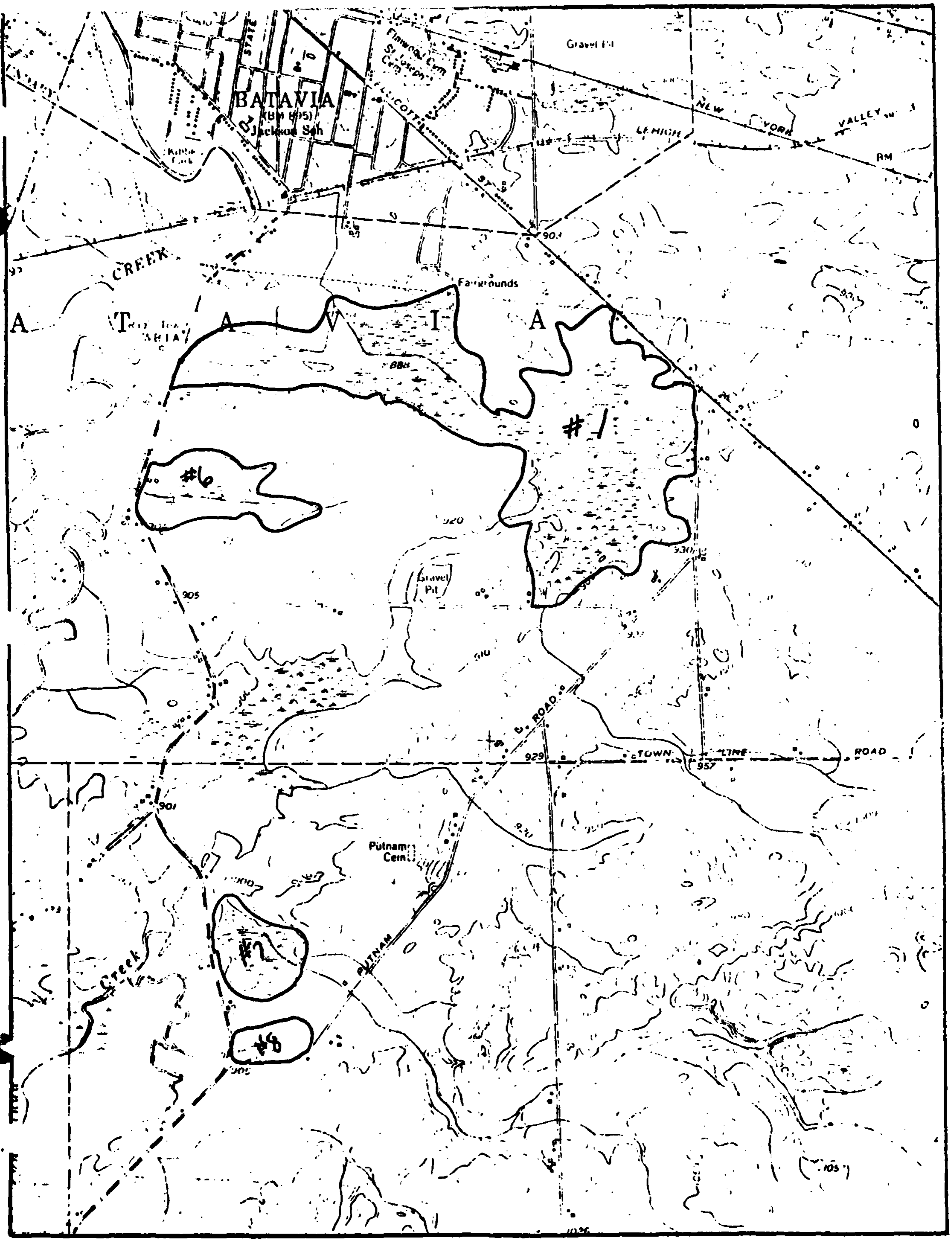
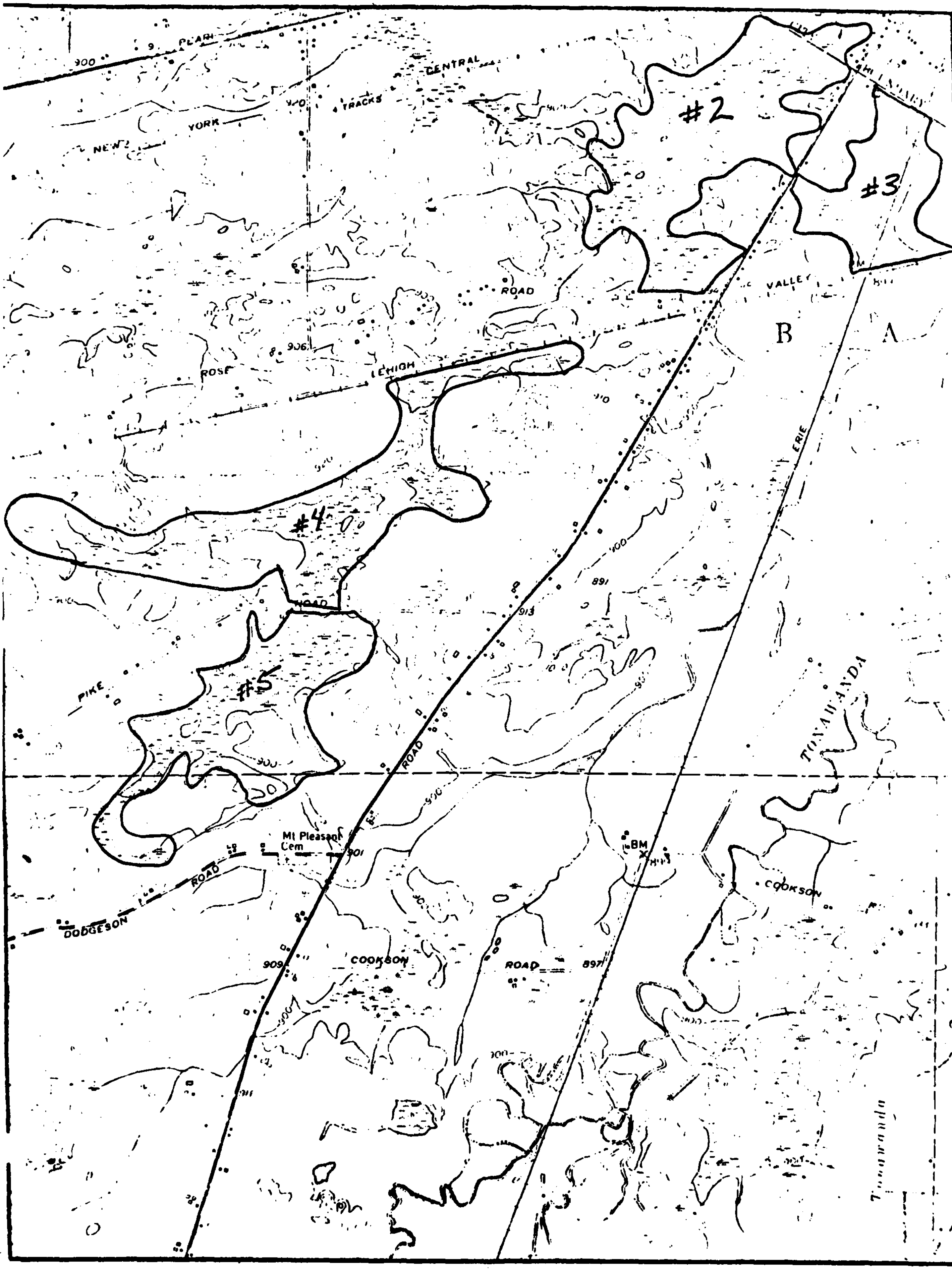



USGS 7.5' Quad, Batavia South, 1950




USGS 7.5' Quad. Batavia South 1950

APPENDIX A
BIOLOGICAL STUDIES AND FISH AND WILDLIFE COORDINATION

SECTION A-2
FISH SURVEY REPORT

CONTRACT NO. DACW49-79-C-0052
U.S. Army Corps of Engineers
Buffalo District
1776 Niagara Street
Buffalo, New York

# FISH SURVEY
# TONAWANDA CREEK WATERSHED
# BATAVIA to ALEXANDER
# GENESEE COUNTY, NEW YORK
# JUNE - JULY 1979

Submitted by:
Bio Systems Research, Inc.
455 Cayuga Rd.
Buffalo, New York 14225
August 1979

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SUMMARY

A fish survey of Tonawanda Creek and its watershed between Batavia and Alexander in Genesee County, New York was performed between June 25 and July 20, 1979, in fulfillment of Contract No. DACW49-79-C-0052, U.S. Army Corps of Engineers, Buffalo District. Thirty four individual sites were sampled, including 11 locations on Tonawanda Creek, 10 on Little Tonawanda Creek, one nameless tributary of Tonawanda Creek, and 12 ponds. Collection methods consisted of backpack electrofishing, seining, gill netting, dip netting, and angling. A total of 27 species were collected, of which four were game fish; brown trout (*Salmo trutta*), northern pike (*Esox lucius*), smallmouth bass (*Micropterus dolomieui*), and largemouth bass (*M. salmoides*). The remaining species were members of the following families: Umbridae (1 species), Cyprinidae (11), Catostomidae (2), Ictaluridae (1), Centrarchidae (4), and Percidae (4).

## INTRODUCTION

A fish survey was conducted in Tonawanda Creek and its watershed between Alexander and Batavia, New York between June 25 and July 20, 1979. During this time period, water levels were very low relative to springtime conditions. Tonawanda Creek was typically low and turbid, with slow current. The banks were usually mud and the shores wooded or brushy. Fallen trees and branches often stretched across parts of the stream. Water depths varied and were often greater than 1.3m, making sampling difficult. Water temperatures varied from 15.5 to 25°C. Eleven different locations were sampled in Tonawanda Creek. Three of these 11 sites were sampled twice, at one site to use different gear, and at the other two sites, the second sampling was an attempt to estimate biomass using block netting.

Little Tonawanda Creek varied greatly in character. The upstream stretches near Linden were low, clear, rocky, and had moderate flow. The downstream stretches were more turbid, silt-laden, and had a slow current. Water temperatures ranged from 14.5 to 31°C during the study period. Ten distinct sites on Little Tonawanda Creek, including one tributary, were sampled. One site was sampled twice.

A number of small ponds were located in the watershed, and 12 of these were sampled. The ponds were typically warm, (19-26°C) and turbid with mud bottoms. Most had low water

levels, and several were the remains of ephemeral tributaries. For a detailed description of all the collection sites and their locations, refer to Table 1, Figure 1, and Appendix A.

## METHODS AND MATERIALS

Due to the varied characteristics of sampling sites in the watershed, several collection methods were used. The various gear types used at each location and date are summarized in Table 1.

A backpack electrofishing unit, consisting of a gasoline powered generator, was used. Shocking was attempted with 110 and 220 volts in both alternating (AC) and direct current (DC) modes. However, due to the high turbidity of the water, DC proved to be more effective since the fish were attracted to the anode and could be seen and captured by the netters. One person carried the backpack unit and operated the electrodes, while two other people walked on either side and netted the fish. The two pick-up nets resembled landing nets with wooden poles (6', 1.8m, in length), hoop diameters of 13" (33.0cm ) and 15" (38.1cm) respectively, and a netting mesh size of 1/8" (3.2mm).

Seining was done using a 25' x 4' x 1/8" mesh (7.6m x 1.2m x 3.2mm mesh) seine. When possible seine hauls were made with the seine stretched across the stream and worked upstream. Hauls were made both parallel and perpendicular to shore, or by encircling an area. Usually several seine hauls were made at each site until no or few different species were collected. Seining was performed at two sites in Tonawanda Creek, five sites in Little Tonawanda Creek, one nameless tributary, and

eight ponds (Table 1).

Gill nets were used in Tonawanda Creek at the four sites furthest downstream near Batavia. The stream's depth and steep banks made seining and backpack shocking impractical. On July 19 and 20, two gill nets were set each day using a canoe. The nets were set between 1000 and 1100 hours and pulled between 1400 and 1500 hours on the same day to reduce the risk of vandalism. The nets used were 225' x 4' (68.6m x 1.2m) experimental gill nets consisting of nine 25' (7.6m) multifilament panels with bar mesh sizes of 0.50" (1.3cm), 0.75" (1.9cm), 1.00" (2.5cm), 1.25" (3.2cm), 1.50" (3.8cm), 1.75" (4.4cm), 2.00" (5.1cm), 2.50" (6.4cm), and 3.00" (7.6cm). On July 20 after the gill nets were set, angling was conducted for 2.5 man hours with spinning tackle.

In very small ponds where seining was impossible, the dip nets used during electrofishing were swept through the water and aquatic vegetation. On July 20, a small aquarium dip net (mesh size less than 0.5mm) was used to collect fish larvae and juveniles.

Fish were identified in the field when possible and released. Representative specimens of unidentified fish were preserved in 10% formalin and later identified in the laboratory. Adults and juveniles were identified using keys and descriptions in Blair et al. 1969, Eddy 1957, Pflieger 1975, and Scott and Crossman 1973. Larvae were identified using Fish 1932, Lippson and Moran 1974, Meyer 1970, Snyder et al. 1977, and Wang and Kernehan 1979.

To estimate the standing crop of game fish species, three sections of Tonawanda Creek were blocked off and electrofished. The linear dimensions of the blocked sections were 200' (61.0m) at the Peaviner Rd. bridge, 150' (45.7m) near the Cookson Rd. bridge, and 125' (38.1m) near the Dorman Rd. bridge. Stream width was approximately 30' (9.1m) at each of the three sites, yielding areas of 6000 $ft^2$ (555.1$m^2$), 4500 $ft^2$ (415.9$m^2$), and 3750 $ft^2$ (346.7$m^2$), respectively. One 50' x 6' x ¼" mesh (15.2m x 1.8m x 6.4mm mesh) seine was placed at each end of the stream section and the enclosed area thoroughly electrofished twice; all shocked fish were netted, measured, and released downstream. Adult game fish were measured to the nearest mm of total length and were weighed to the nearest gram on a dietary scale. The total weight of adults of each game species, divided by the area of the enclosed stretch, was used as an estimate of standing crop or biomass and expressed as lbs/acre (kg/ha).

## RESULTS

A total of 27 species were collected (Table 2), including four game species; brown trout (Salmo trutta), northern pike (Esox lucius), smallmouth bass (Micropterus dolomieui), and largemouth bass (M. salmoides). The remaining species were in the following families: Unbridae (1 species), Cyprinidae (11), Catostomidae (2), Ictaluridae (1), Centrarchidae (4), and Percidae (4).

### Tonawanda Creek

In Tonawanda Creek, 20 species were collected, including northern pike, smallmouth bass, and largemouth bass. Nine species of cyprinids, two catostomids, one ictalurid, two centrarchids, and three percids comprised the remainder. The most common species were the common shiner (Notropis cornutus), taken at seven of the 11 sites, bluntnose minnow (Pimephales notatus), found at seven sites, hog sucker (Hypentelium nigricans), six sites, and rock bass (Ambloplites rupestris), seven sites. Three species were collected in Tonawanda Creek only: largemouth bass, sand shiner (Notropis stramineus), and logperch (Percina caprodes).

The species assemblages were rather similar at most sites. Site 1, which is an oxbow (Figure 1), had a slightly different assemblage including largemouth bass, golden shiners (Notemigonus crysoleucas), brown bullheads

(*Ictalurus nebulosus*), pumpkinseeds (*Lepomis gibbosus*), and yellow perch (*Perca flavescens*). These species are more typical of ponds and lakes; the slow, muddy water of the oxbow was more characteristic of a pond than a stream.

Little Tonawanda Creek

In Little Tonawanda Creek, 17 species were collected. Game species included brown trout, northern pike, and smallmouth bass. The remaining species were in the families Cyprinidae (7 species), Catostomidae (2), Centrarchidae (3), and Percidae (2). The species occurring in the greatest number of collections were white sucker (*Catostomus commersoni*), six sites, hog sucker, seven sites, and smallmouth bass, seven sites. Two species were found only in Little Tonawanda Creek: brown trout and the fantail darter (*Etheostoma flabellare*). These two species are found in higher gradient, clear, clean water streams, and were collected in the upstream stretches.

The assemblages of species were found to vary with stream characteristics. In the upstream reaches, swifter water species were found, such as brown trout, fantail darter, blacknose dace (*Rhinichthys atratulus*), and central stoneroller (*Campostoma anomalum*). In the middle stretches, smallmouth bass became the most abundant game species, and in the downstream areas, northern pike were the dominant

predators. Little Tonawanda Creek appears to be an important spawning and nursery stream for both smallmouth bass and northern pike, since a large number of young-of-the-year and juveniles of these species were present (Table 3).

Ponds

Eighteen species were collected in the ponds. The only game species was northern pike, which occurred in fair abundance in four of the 12 ponds. One species of Umbridae, eight cyprinids, one catostomid, one ictalurid, four centrarchids, and two percids comprised the remainder of the collection. The most common species were the golden shiner (eight sites) and pumpkinseed (six sites). Four species were found only in ponds: the central mudminnow (*Umbra limi*), carp (*Cyprinus carpio*), fathead minnow (*Pimephales promelas*), and bluegill (*Lepomis macrochirus*). These species are typically found in warm lentic waters.

The species assemblages in several ponds (sites 20, 22, 23) more closely resembled the assemblage in Tonawanda Creek. These ponds appeared to be remainders of ephemeral tributaries, and the fish were probably trapped by receding waters. Several ponds showed evidence of reproduction of game and pan fish. Ponds number 18, 6, 28, and 27 contained juvenile northern pike. Pond 6 in

particular contained abundant juveniles and several adults (Table 3). Ponds 20, 19, 18, 6, 28, 27 all contained either sunfish juveniles, larvae, or both.

Game Fish Biomass Estimates

A summary of data on the four game species is presented in Table 3, including biomass estimates for Tonawanda Creek. In general, so few game fish were collected in Tonawanda Creek that the resultant biomass estimates should be viewed with extreme caution and be considered extreme minimum values. Several factors, commonly encountered in studies of standing crops, are thought to have influenced the capture of game fish in the area, thus leading to an underestimate of biomass. The effectiveness of electroshocking was no doubt reduced because of the high turbidity and presumed high conductivity of the water. The presence of underwater obstructions limited success of sampling by seining. Also the disturbance in setting the block nets may have caused large game fish to leave the immediate area. Another facet to consider was the difficulty in sampling Tonawanda Creek. Those areas accessible for block netting were the shallower, swifter sections because these were the only ones that could be safely sampled with electrofishing equipment. Much of the stream was too deep and the banks too steep to permit block netting and shocking.

The only adult or subadult game fish taken in any of the block net efforts were smallmouth bass. At sites 3, 8, and 12,

the estimated standing crop during the study period was 1.04 lb/acre (1.16kg/ha), 2.12 lb/acre (2.37kg/ha), and 3.59 lb/acre (4.03kg/ha), respectively. To reiterate, these should be viewed as minimum values.

Comparison of Results Among Collection Gear

Electrofishing and seining produced rather similar collections of fish species (Tables 1 and 2). Gill netting during daylight only, was relatively ineffective; a total of five fish from four nets were taken during 16 hours of fishing effort. Angling near the same areas and at the same time that the gill nets were set showed that game and pan fish were much more abundant than would have been inferred from the gill net catch. A total of two smallmouth bass, one northern pike, and nine rock bass were taken in 2.5 hours of fishing (angling) effort. This equals 4.8 fish/hour, in contrast to an average of 0.3 fish/hour for the gill nets. Twenty four-hour gill net sets would probably have collected more nocturnal species, such as bullheads.

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## DISCUSSION

When evaluating the quality of the fishery of Tonawanda Creek, based on the results of this survey, one should keep the previously discussed sampling limitations in mind. Large active fish such as game species were very difficult to collect due to excess turbidity, water depth, and the frequent occurrence of underwater obstructions. There are indications that the fishery could be substantially better than the actual catch data leads one to believe. For example, a much greater number of smallmouth bass and northern pike juveniles were observed in the downstream areas near Batavia than were caught in gill nets (see Appendix A). Despite the fact few game and pan fish were collected in Tonawanda Creek, the observation that most were juveniles or young of the year indicates reproduction had occurred and that a greater proportion of adults were probably present somewhere in the watershed than were collected. A limited northern pike and smallmouth bass fishery probably existed throughout the study location. Largemouth bass fry were collected at only one site, the oxbow. Habitat quality of Tonawanda Creek in general was not high due to the mud bottom, high turbidity, and sluggish current.

Little Tonawanda Creek appeared to have a much higher habitat quality than Tonawanda Creek. A greater gradient in the upstream sections contributed to the clearer water and a bottom with less silt. However, water temperature was occasionally higher than optimum due to shadeless stretches through

pasture land. A fair population of brown trout appear to exist in the far upstream reaches near Linden. Smallmouth bass reproduction was good in the middle stretches, and northern pike reproduction was good in the vegetated, slower downstream waters near Tonawanda Creek.

Most of the ponds suffered from low water levels in summer and excessive turbidity. Despite this, several had reasonable numbers of northern pike juveniles and adults. During high water levels in spring, most of the ponds are probably contiguous with Tonawanda Creek. During this time, creek fish may spawn in the ponds. Also, juveniles reared in the ponds may re-enter the creek fishery. Some ponds, particularly site 6, probably sustain self reproducing populations.

## REFERENCES

Blair, W.F., A.P. Blair, P. Brodkorb, E.R. Cagle, and G.A. Moore. 1969. The Vertebrates of the United States. McGraw-Hill Book Co., Inc. 819 pp.

Eddy, S. 1957. How to Know the Freshwater Fishes. Wm. C. Brown Co. 253 pp.

Fish, M.P. 1932. Contributions to the early life histories of sixty-two species of fishes from Lake Erie and its tributary waters. Bull. (U.S.) Bur. Fish., 47(10): 293-398.

Lippson, A.J., and R.L. Moran. 1974. Manual for identification of early developmental stages of fishes of the Potomac River Estuary. Environ. Tech. Center, Martin Marietta Corp., Baltimore, Md. Spec. Publ., PPSP - MP - 13: 282 pp.

Meyer, F.A. 1970. Development of some larval centrarchids. Prog. Fish. Cult., July: 130-136.

Pflieger, W.L. 1975. The Fishes of Missouri. Missouri Dept. Conservation. 343 pp.

Scott, W.B., and E.J. Crossman. 1973. Freshwater Fishes of Canada. Bull. No. 184, Fish. Res. Bd. Can. 966 pp.

Snyder, D.E., M.B.M. Snyder, and S.C. Douglas. 1977. Identification of golden shiner, <u>Notemigonus crysoleucas</u>, spotfin shiner, <u>Notropis spilopterus</u>, and fathead minnow, <u>Pimephales promelas</u>, larvae. J. Fish. Res. Bd. Can., 34:1397-1409.

Wang, J.C.S., and R.J. Kernehan. 1979. Fishes of the Delaware Estuaries. EA Communications, Towson, Maryland. 410 pp.

TABLE 1
COLLECTION SITE LOCATION DESCRIPTIONS, DATES, AND GEAR USED
IN 1979 TONAWANDA CREEK FISH SURVEY

| General Description | Collection[1] Number | Specific Site Location | Gear Type[2] | Date |
|---|---|---|---|---|
| **Tonawanda Creek** | | | | |
| upstream | 2 | Upstream of Rt. 20 bridge near Alexander | E | June 25 |
| | 1 | Oxbow just downstream of Rt. 20 | E,S | June 25<br>July 12 |
| | 3 | Peaviner Rd. bridge | E,E and block nets | June 25<br>July 6 |
| | 25 | Old railroad bridge ¼ mi S of Cookson Rd. | S | July 13 |
| | 8 | Cookson Rd. bridge | E,E and block nets | June 29<br>July 5 |
| | 5 | Dorman Rd. bridge | E | June 25 |
| | 12 | Downstream of Dorman Rd. bridge, off farmer's field | E and block nets | July 5 |
| | 34 | ½mi upstream of Lehigh Valley RR bridge S of Batavia | G, dip net | July 20 |
| | 33 | ¼mi upstream of Lehigh Valley RR bridge | G, angling | July 20 |
| | 32 | Just upstream of Lehigh Valley RR bridge | G | July 19 |
| downstream | 31 | Just downstream of Kibble Park in Batavia | G | July 19 |
| **Little Tonawanda Creek** | | | | |
| upstream | 16 | Tributary at Silver Rd. bridge near RR tracks | 1/8" mesh dip nets | July 6 |
| | 15 | Mill Rd., ½mi downstream of gaging station | E | July 6 |
| | 14 | Silver Rd. bridge | E | July 6 |
| | 13 | Rt. 20 bridge | E | July 5 |
| | 30 | Town Line Rd. bridge ¼mi S of Gilhooly Rd. | S | July 13 |
| | 17 | Bridge on road between Town Line Rd. and Brookville Rd. | E | July 6 |
| | 29 | Town Line Rd. bridge just S of Brookville Rd. | S | July 13 |
| | 10 | Town Line Rd. bridge N of Brookville Rd. | S | June 29 |
| | 11 | Town Line Rd. just S of Old Creek Rd. | S | June 29 |
| downstream | 4 | Old Creed Rd. bridge | S, S | June 25,<br>July 12 |
| Nameless Tributary | 21 | Brookville Rd. bridge just N of Rt. 20 | S | July 12 |

TABLE 1 (CONT.)

| General Description | Collection Number | Specific Site Location | Gear Type | Date |
|---|---|---|---|---|
| **Ponds** | | | | |
| south | 22 | Small pond near Erie RR 1.5 mi N of Rt. 20 | S | July 12 |
| | 23 | Small pond near Erie RR 1.5 mi N of Rt. 20 | S | July 12 |
| | 9 | Large pond off Peaviner Rd. next to Delaware Lackawanna RR | S | June 29 |
| | 24 | Channel by old RR crossing of Erie and Delaware Lackawanna | E | July 12 |
| | 20 | Small pond at Peaviner Rd. by old Erie RR bridge | S | July 12 |
| | 19 | Small pond at Old Creek Rd. bridge ¼mi N of Peaviner Rd. | S | July 12 |
| | 18 | Small pond at Old Creek Rd. bridge ¼mi S of Cookson Rd. | S | July 12 |
| | 7 | Small pond at Cookson Rd. culvert, 2/3mi E of Rt. 98 | 1/8" mesh dip net | June 29 |
| | 6 | Deep pond and backwater at Cookson Rd 1/3mi E of Rt. 98 | E | June 29 |
| | 28 | Pond in cow pasture by old Erie RR ¼mi N of Cookson Rd. | S | July 13 |
| | 27 | Pond in cow pasture by old Erie RR 3/4mi N of Cookson Rd. | S | July 13 |
| north | 26 | Small pool, part of swamp, by old Erie RR 1mi N of Cookson Rd. | 1/8" mesh dip net | July 13 |

NOTE: 1. Collection numbers refer to field notes in Appendix A and Figure 1.
2. E = backpack electrofishing, S = seine, G = gill net

TABLE 2
RELATIVE ABUNDANCE[1] AND LOCATION[2] OF ALL FISH SPECIES COLLECTED IN 1979
TONAWANDA CREEK SURVEY

COLLECTION SITE

**Tonawanda Creek** (Upstream ——— Downstream)

| SPECIES | 2 | 1 | 3 | 25 | 8 | 5 | 12 | 34 | 33 | 32[3] | 31 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Salmonidae | | | | | | | | | | | |
| *Salmo trutta* | | | | | | | | | | | |
| Umbridae | | | | | | | | | | | |
| *Umbra limi* | | | | | | | | | | | |
| Esocidae | | | | | | | | | | | |
| *Esox lucius* | | | | | F | | | F | F[4] | | |
| Cyprinidae | | | | | | | | | | | |
| *Campostoma anomalum* | F | F | | C | C | | F | | | | |
| *Cyprinus carpio* | | | | | | | | | | | |
| *Nocomis biguttatus* | F | | F | C | A | | C | | | | |
| *Notemigonus crysoleucas* | | C | | | | | | | | | |
| *Notropis cornutus* | F | C | A | A | A | F | | A[5] | | | |
| *Notropis stramineus* | | | | | F | | | | | | |
| *Pimephales notatus* | | C | C | F | C | C | F | A[5] | | | |
| *Pimephales promelas* | | | | | | | | | | | |
| *Rhinichthys atratulus* | | F | | | | | | | | | |
| *Semotilus atromaculatus* | C | C | | F | F | | | | | | |
| *Semotilus corporalis* | C | | F | F | C | F | | | | | |
| Unidentified larvae or juveniles | | A | F | | | | | | | | |
| Catostomidae | | | | | | | | | | | |
| *Catostomus commersoni* | | F | F | C | F | | | | F | | F |
| *Hypentelium nigricans* | F | | A | F | C | F | A | | | | |
| Unidentified larvae or juveniles | | | F | | | | | | | | |
| Ictaluridae | | | | | | | | | | | |
| *Ictalurus nebulosus* | | A | | | | | | F | | | |

**Little Tonawanda Creek** (Upstream ——— Downstream)

| SPECIES | 16 | 15 | 14 | 13 | 30 | 17 | 29 | 10 | 11 | 4 |
|---|---|---|---|---|---|---|---|---|---|---|
| Salmonidae | | | | | | | | | | |
| *Salmo trutta* | | F | F | | | | | | | |
| Umbridae | | | | | | | | | | |
| *Umbra limi* | | | | | | | | | | |
| Esocidae | | | | | | | | | | |
| *Esox lucius* | | | | | | | | | F | C |
| Cyprinidae | | | | | | | | | | |
| *Campostoma anomalum* | | A | A | | | | F | A | | |
| *Cyprinus carpio* | | | | | | | | | | |
| *Nocomis biguttatus* | | | | | | | | | | F |
| *Notemigonus crysoleucas* | | | | | | | | | | |
| *Notropis cornutus* | | F | A | | | | A | C | | |
| *Notropis stramineus* | | | | | | | | | | |
| *Pimephales notatus* | | | F | | | | F | | F | F |
| *Pimephales promelas* | | | | | | | | | | |
| *Rhinichthys atratulus* | | A | | | | | F | | | |
| *Semotilus atromaculatus* | A | C | C | | | | F | | | |
| *Semotilus corporalis* | | | | F | | | F | F | | |
| Unidentified larvae or juveniles | | | | | | | | C | | |
| Catostomidae | | | | | | | | | | |
| *Catostomus commersoni* | | C | A | C | | A | F | F | | |
| *Hypentelium nigricans* | | C | A | A | A | C | C | C | | |
| Unidentified larvae or juveniles | | | | | | | | | | |
| Ictaluridae | | | | | | | | | | |
| *Ictalurus nebulosus* | | | | | | | | | | |

**Ponds** (South ——— North)

| SPECIES | 21[6] | 22 | 23 | 9 | 24 | 20 | 19 | 18 | 7 | 6 | 28 | 27 | 26 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Salmonidae | | | | | | | | | | | | | |
| *Salmo trutta* | | | | | | | | | | | | | |
| Umbridae | | | | | | | | | | | | | |
| *Umbra limi* | | F | | C | F | | | F | | | | | A |
| Esocidae | | | | | | | | | | | | | |
| *Esox lucius* | | | | | | | | C | | A | C | F | |
| Cyprinidae | | | | | | | | | | | | | |
| *Campostoma anomalum* | C | | | | | | | | | | | | |
| *Cyprinus carpio* | | | | | | | | | | F | | | |
| *Nocomis biguttatus* | | | | | | | | | | | | | |
| *Notemigonus crysoleucas* | C | A | C | C | | F | C | | | | A | A | C |
| *Notropis cornutus* | A | F | A | | | C | | | | | | F | |
| *Notropis stramineus* | | | | | | | | | | | | | |
| *Pimephales notatus* | F | A | C | | | A | | | | | | | |
| *Pimephales promelas* | F | A | C | | | | | | | | | | |
| *Rhinichthys atratulus* | F | F | | | | | | | | | | | |
| *Semotilus atromaculatus* | F | F | F | | | F | | | F | | | | |
| *Semotilus corporalis* | F | F | | | | F | | | F | | | | |
| Unidentified larvae or juveniles | | | | | | C | | | C | | | | |
| Catostomidae | | | | | | | | | | | | | |
| *Catostomus commersoni* | A | F | | | | | | | | | | | |
| *Hypentelium nigricans* | | | | | | | | | | | | | |
| Unidentified larvae or juveniles | | | | | | | | | | | | | |
| Ictaluridae | | | | | | | | | | | | | |
| *Ictalurus nebulosus* | | | | | | F | | | | A | C | F | |

Sheet 1 of 2

TABLE 2 (CONT.)

| SPECIES | COLLECTION SITE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Tonawanda Creek | | | | | | | | | | | Little Tonawanda Creek | | | | | | | | | | Ponds | | | | | | | | | | | | |
| | Upstream ——— Downstream | | | | | | | | | | | Upstream ——— Downstream | | | | | | | | | | South ——— North | | | | | | | | | | | | |
| | 2 | 1 | 3 | 25 | 8 | 5 | 12 | 34 | 33 | 32[3] | 31 | 16 | 15 | 14 | 13 | 30 | 17 | 29 | 10 | 11 | 4 | 21[6] | 22 | 23 | 9 | 24 | 20 | 19 | 18 | 7 | 6 | 28 | 27 | 26 |
| Centrarchidae | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Ambloplites rupestris* | F | A | F | | C | F | C | | C[4] | | | | | | | | F | | | F | F | F | | | | | | | F | | | | | |
| *Micropterus dolomieui* | | | F | | F | | F | F | F[4] | | | | F | F | F | C | F | A | F | | | | | | | | | | | | | | | |
| *Micropterus salmoides* | | A | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Lepomis cyanellus* | | | | | | | | | | | | | | | F | | | | | | | F | | | | | | F | | | F | C | | |
| *Lepomis gibbosus* | | F | | | F | | | | | | | | F | | F | | | | | F | F | | | | F | | | C | C | | A | A | A | |
| *Lepomis macrochirus* | | | | | | | | | | | | | | | | | | | | | | | | | | | F | | | | | | | |
| Unidentified larvae or juveniles | | | | | | | | | | | | | | | | | | | | | | | | | | | C | | | | | | | |
| Percidae | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Etheostoma flabellare* | | | | | | | | | | | | | A | | F | | F | F | F | | | F | | | | | | | | | | | | |
| *Etheostoma nigrum* | | | F | C | F | F | A | | | | | | | | F | | | | F | F | C | C | | | | | C | | | | | | | |
| *Percina caprodes* | | | | F | | F | C | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Perca flavescens* | | F | | | | | | | | | | | | | | | | | | | | | | | | | | | F | | | | | |

NOTE:
1. A = abundant, > 12 specimens collected; C = common, 5-12 specimens; F = few, < 5 specimens
2. Collection Site Numbers are described in Table 1 and in the Appendix
3. No fish collected
4. Data represent angling collection from sites 31-34
5. Data represent dip net collection of larvae at sites 33-34
6. Site 21 is a nameless tributary, not a pond

TABLE 3
DATA SUMMARY OF GAME FISH SPECIES COLLECTED IN 1979
TONAWANDA CREEK SURVEY

| Species | Location[1] | Collection[5] Number | Life Stage | Number Collected | Total Length (mm) | Weight (g) | Area of Stream Blocked | Estimated Biomass kg/ha | Estimated Biomass lb/acre |
|---|---|---|---|---|---|---|---|---|---|
| Salmo trutta | L | 15 | Adult | 3 | 180 | - | | | |
| | | | | | 278 | 200 | | | |
| | | | | | 268 | 230 | | | |
| | L | 14 | Adult | 1 | 196 | 95 | | | |
| | Total | | Adult | 4 | | | | | |
| Esox lucius | T | 8 | Juvenile | 1 | | | | | |
| | T | 8[2]* | Juvenile | 2 | | | 416 $m^2$ | - | |
| | T | 34 | Juvenile | 1 | | | | | |
| | T | 33[3] | Subadult | 1 | 370 | - | | | |
| | Total T | | Juvenile | 4 | | | | | |
| | | | Subadult | 1 | | | | | |
| | L | 11 | Juvenile | 1 | | | | | |
| | L | 4 | Juvenile | 11 | | | | | |
| | L | 4[2] | Juvenile | 1 | | | | | |
| | Total L | | Juvenile | 13 | | | | | |
| | P | 18 | Juvenile | 6 | | | | | |
| | P | 18 | Adult | 1 | escaped | seine | | | |
| | P | 6 | Juvenile | 40 | | | | | |
| | P | 6 | Adult | 3 | 465 | 530 | | | |
| | | | | | 473 | 600 | | | |
| | | | | | 398 | 360 | | | |
| | P | 28 | Juvenile | 5 | | | | | |
| | P | 28 | Adult | 1 | escaped | seine | | | |
| | P | 27 | Juvenile | 3 | | | | | |
| | Total P | | Juvenile | 54 | | | | | |
| | | | Adult | 5 | | | | | |

TABLE 3 (CONT.)

| Species | Location[1] | Collection[5] Number | Life Stage | Number Collected | Total Length (mm) | Weight (g) | Area of Stream Blocked | Estimated Biomass kg/ha | Estimated Biomass lb/acre |
|---|---|---|---|---|---|---|---|---|---|
| *Micropterus dolomieui* | T | 3[2]* | YOY[4] | 1 | | | | | |
| | T | 3[2]* | Adult | 1 | 180 | 65 | 555 $m^2$ | 1.16 | 1.04 |
| | T | 8 | Juvenile | 1 | | | | | |
| | T | 8[2]* | Adult | 1 | 190 | 99 | 416 $m^2$ | 2.37 | 2.12 |
| | T | 12* | Adult | 2 | 184 | 80 | | | |
| | | | | | 174 | 60 | 347 $m^2$ | 4.03 | 3.59 |
| | T | 34 | Juvenile | 1 | | | | | |
| | T | 33[3] | Adult | 1 | 340 | - | | | |
| | T | 33[3] | Juvenile | 1 | | | | | |
| | Total T | | YOY | 1 | | | | | |
| | | | Juvenile | 3 | | | | | |
| | | | Adult | 5 | | | | | |
| | L | 15 | Juvenile | 2 | | | | | |
| | L | 14 | Juvenile | 1 | | | | | |
| | L | 14 | Adult | 1 | 281 | 290 | | | |
| | L | 13 | Juvenile | 3 | | | | | |
| | L | 13 | Adult | 3 | 163 | 50 | | | |
| | | | | | 185 | 80 | | | |
| | | | | | 221 | 117 | | | |
| | L | 30 | YOY | 6 | | | | | |
| | L | 30 | Adult | 1 | escaped | seine | | | |
| | L | 17 | YOY | 1 | | | | | |
| | L | 17 | Adult | 3 | 191 | 110 | | | |
| | | | | | 173 | 75 | | | |
| | | | | | 256 | 210 | | | |
| | L | 29 | YOY | 11 | | | | | |
| | L | 29 | Juvenile | 9 | | | | | |
| | L | 10 | Juvenile | 3 | | | | | |
| | Total L | | YOY | 18 | | | | | |
| | | | Juvenile | 18 | | | | | |
| | | | Adult | 8 | | | | | |
| *Micropterus salmoides* | T | 1 | YOY | few large schools of fry | | | | | |
| | T | 1[2] | YOY | 4 | | | | | |

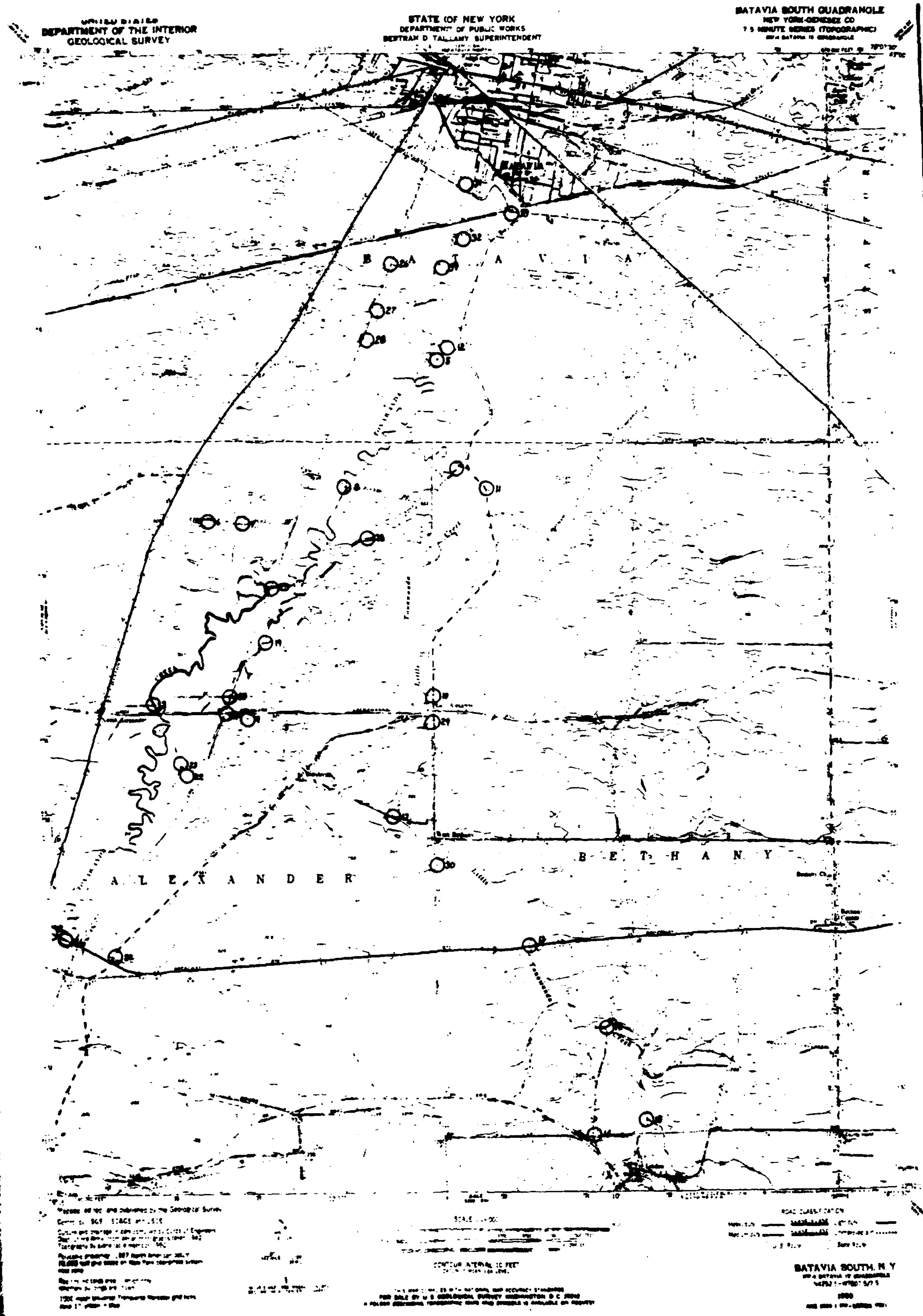
TABLE 3 (CONT.)

NOTE:

1. T = Tonawanda Creek
   L = Little Tonawanda Creek
   P = Pond

* Site was block netted for biomass estimates

2. Second time site was sampled
3. Fish collected by angling
4. YOY = young of the year
5. See Table 1 for description of site location


DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
BERTRAM D. TALLAMY SUPERINTENDENT
BATAVIA SOUTH QUADRANGLE
NEW YORK-GENESEE CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
B A T A V I A
A L E X A N D E R
B E T H A N Y
CONTOUR INTERVAL 10 FEET
ROAD CLASSIFICATION
BATAVIA SOUTH, N.Y.

APPENDIX A
BIOLOGICAL STUDIES AND FISH AND WILDLIFE COORDINATION

SECTION A-3
ENDANGERED SPECIES ASSESSMENT

A number of plant and animal species, whose existence is considered to be in peril, have present or prior natural ranges which encompass the Tonawanda Creek watershed area. These species, as discussed below and presented in the table which follows, are protected by the Federal Government under the Endangered Species Act of 1973, as amended and by New York State under the Environmental Conservation Law. The Endangered Species Act makes it a violation of Federal Law to take any species which are listed as Endangered, except under permit to enhance the propagation or survival of the species. Threatened species are considered to be in less peril of survival but could possibly become endangered in the near future in a portion or all of their range and regulations on their taking are less rigorous.

Of the 10 species presented in the table, only four have much possibility of occurring in the vicinity of the proposed Batavia Reservoir Coumpound (Modified) area. These four are the: (1) Bald eagle (Haliaeetus leucocephalus); (2) Peregrine falcon (Falco peregrinus); (3) Osprey (Pandion haliaetus);and (4) Bog turtle (Clemmys muhlenbergi). No recent observations of any of these four species as breeding individuals has been made in the project area. Any of the three species of birds are likely to be seen at various times in the area due to their wide ranging migratory and transient movements. However, no habitat, that could be considered critical to their survival has been identified within the confines of the Batavia Reservoir Coumpound (Modified).

The U.S. Fish and Wildlife Service is currently conducting biological surveys of the Batavia Reservoir Compound area ans is also preparing an official Fish and Wildlife Coordination Act Report. The results of the Fish and Wildlife studies may lead to some updating or revisions to this endangered species assessment.

TONAWANDA CREEK, NEW YORK
POSSIBLE ENDANGERED SPECIES

| Name | Protection | Habitat | Remarks |
|---|---|---|---|
| Indiana bat<br>Myotis sodalis | NYE,FE | Limestone cave areas. | Roosting caves known along the Black River, St. Lawrence County, New York. |
| Eastern cougar<br>Felis concolor cougar | NYE,FE | Wilderness areas of mountains, forests, and swamps. | Last authenthic New York State record from 1894. |
| Eastern timer wolf<br>Canis lupus lycaon | NYE,FE | Wilderness forests and tundra. | Only New York State record in this century dates from 1968 in Fulton County. |
| Bald eagle<br>Haliaeetus leucocephalus<br>(two subspecies) | NYE,FE | Near oceans, rivers, and lakes. | Formerly a fairly commen spring and fall migrant along the the Lake Ontario shoreline. Today, rather rare in New York State, only one breeding location known. NYSDEC program to reestablish breeding populations in the state being undertaken. |
| Peregring falcon<br>Falco peregrinus<br>(two subspecies) | NYE,FE | Anywhere during migration, breeds on on cliffs. Arctic subspecies breeds in tundra regions. | Rare inland migrant occasionally seen along the Lake Ontario shoreline. No New York State nestings since 1961. Pesticide contamination has led to drastic declines in populations. |
| Osprey<br>Pandion haliaetus | NYE | Near any water body supproting good fish populations. | Fairly common spring and fall migrant along the Lake Ontario shoreline. Some breeding territory in the St. Lawrence River area. Undergoing an apparent reversion in nesting success resulting from restrictions on pesticide use. |
| Bog turtle<br>Clemmys muhlenbergi | NYE | Bogs, swamps | Unknown status in New York State. |
| Karner blue butterfly<br>Lycaeides melissa samuelis | NYE | Sandy areas | Highly specialized larval stages. Largest population found near Albany, New York. |
| Chittenango ovate amber snail<br>Succinea ovalis chittenan-goensis | NYE,FT | Spray zones of water falls. | Only known location at the falls on Chittenango Creek near Cazenovia, New York. |
| Northern wild monkshood<br>Aconitum noveboracense | FT | Moist soil areas near cliffs | One colony known from Ulster County, New York. |

PROTECTION
- NYE - New York Endangered
- FE - Federally Endangered
- FT - Federally Threatened

REFERENCES


Federal Register. 1979. List of Endangered and Threatened Wildlife and Plants. Vol. 44, No. 12, Pages 3636-3654. January 17, 1979

Endangered Species Technical Bulletin. 1978. Furbish Lousewort Among 13 Plant Taxa Newly Listed By Service for Protection. Vol. III, No. 5, U.S. Fish and Wildlife Service, Washington, DC

McCaffrey, E. 1978. New York's Last Chance Wildlife. The Conservationist. Albany, NY. Vol. 33, No. 3, Pages 2-8.

APPENDIX A
BIOLOGICAL STUDIES AND FISH AND WILDLIDE COORDINATION

SECTION A-4
BENTHIC STUDY

# FINAL REPORT

**BENTHIC STUDY ON**

**TONAWANDA CREEK, NEW YORK**

PREPARED FOR

U.S. Army Engineer District, Buffalo
1776 Niagara Street
Buffalo, New York 14207

DACW49-76-C-0039

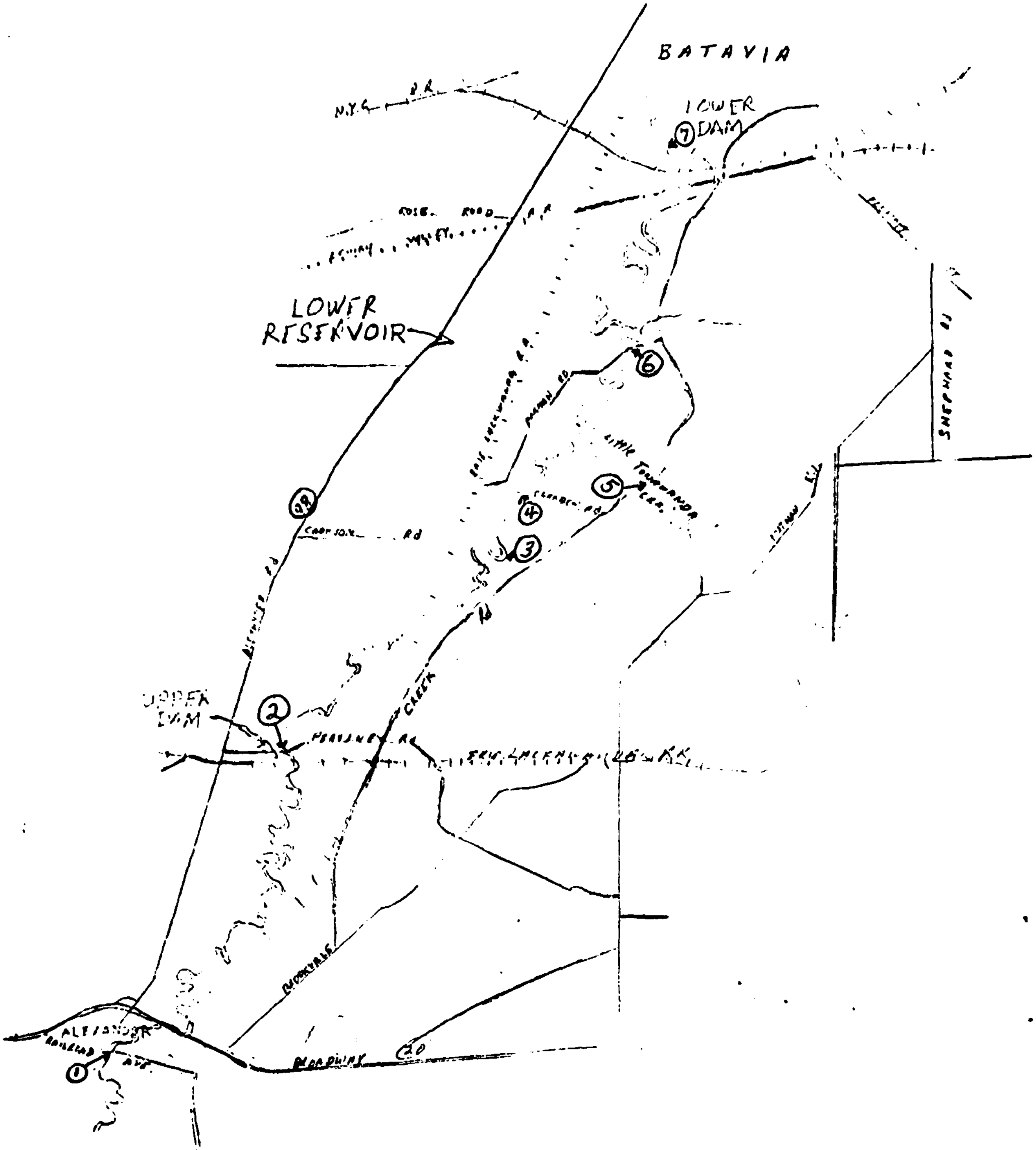
BY

Great Lakes Laboratory
State University College at Buffalo
1300 Elmwood Aveenue
Buffalo, New York 14222

FIELD METHODS

On 30 March 1976, samples were collected from six (6) stations on the Tonawanda Creek and one (1) station on the Little Tonawanda Creek so as to fulfill the requirements as set forth in paragraph 2.1.1 of the contract "Scope of Work" (Figure 1). As agreed upon by the Contracting Officer, Ponar dredge samples were collected at each station. However, due to the rocky nature of the stream bottom at most stations, the samples collected were, for the most part, relatively small. This is attributed to the limitations of the Ponar dredge on rocky substrates. At Station 2 (Figure 1), the Ponar samples were analyzed in the field. They contained only large rocks and a minute amount of very fine sand, and were found to contain no organisms. A field decision was made to supplement the Ponar samples with samples taken with a twelve (12)-inch D-Frame aquatic net. With the exception of Station 1, D-net samples were collected for 30 minutes, and hand-picked in the field. At Station 1, only 15 minutes of D-net collections were made. The D-net samples were intended to be qualitative in nature. Quantitative results are included only to indicate gross relative abundance of the major taxa at individual stations.

All samples were brought back to the laboratory alive. D-net samples were preserved immediately in 10% formalin and 5% glycerine. Ponar samples were sieved in a No. 30 United




NOTE: Station 7 was taken from the bridge at Chestnut Street and Tonawanda Creek.

Figure 1. Station location map of the Tonawanda Creek study area

States Geological Survey sieve (0.59 mm openings) on 1 April 1976 and the organisms (which were still alive) were preserved, as noted previously.

## LAB PROCEDURES

Samples from the Ponar grabs were treated with Rose-Bengal stain, after which they were rinsed in a No. 30 United States Geological Survey sieve. Identification and enumeration of the major taxa was accomplished under a low-power dissecting microscope. Samples 3A and 4A, which contained large amounts of sand, were floated with water to separate the soft bodied organisms, and the sand was checked for mollusks under a 4X magnifying glass. D-net samples were left unstained. Organisms from these samples were identified and enumerated under low-power dissecting microscopes. As the organisms were identified and counted, they were separated and placed in 25 ml vials containing 75% ethanol and 5% glycerine.

Organisms taken via Ponar dredges were further analyzed to the most practicable taxonomic level. D-net samples have been identified to major taxonomic levels. Efforts on the D-net samples were limited in nature and directed toward qualitative results. In those major taxa from both Ponar samples at each station where more than 100 individuals were collected, a random selection of 100

individuals was made by placing the total number in a counting chamber which was divided into eight (8) equal sections; sections were chosen using a random numbers table, and the organisms were removed from selected sections (from left to right) until 100 individuals were obtained. Mounting techniques and taxonomic references are those currently being employed in the Lab in identification work.

## RESULTS

A description of the collection sites are given in the Field Notebook that accompanies this text.

Data are presented in four (4) tables. Table 1 is a listing of major taxonomic groups encountered by all sampling methods at each of the stations examined. Table 2 gives the numbers of the major taxonomic groups per square meter captured using the Ponar Dredge. Station 2 was omitted from the grouping since no organisms were collected with a Ponar from that site. Table 3 lists the numbers from each major taxonomic group collected with the D-Frame aquatic net. Table 4 shows the results of species identification conducted on the specimens taken via Ponar grabs. Numbers are given in organisms per square meter.

Table 1
TONAWANDA CREEK TAXA COLLECTED

| Taxa | Stations | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| Amphipoda | | x | | x | x | x | | x |
| Anisoptera | | | | | | x | x | x |
| Coleoptera | | x | x | x | x | x | x | x |
| Decapoda | | | | | x | x | | |
| Diptera | | | | x | | | | |
| Ceratopogonidae | | | x | | | x | | |
| Chironomidae | | x | x | x | x | x | x | x |
| Simuliidae | | x | x | x | x | x | x | |
| Tabanidae | | | | | | x | x | |
| Ephemeroptera | | x | x | x | x | x | x | |
| Gastropoda | | | | | | x | | x |
| Hemiptera | | | | | | x | | |
| Corixidae | | | x | | | x | x | x |
| Gerridae | | | | x | | | x | |
| Nepidae | | | | | | | | x |
| Hirudinea | | | | | | x | | |
| Hydracarina | | | | | | x | | |
| Isopoda | | | x | x | x | x | x | x |
| Lepidoptera | | | | | | x | | |
| Megaloptera | | | | | | x | | x |
| Nematoda | | | | x | x | x | x | x |
| Oligochaeta | | x | x | x | x | x | x | x |
| Sphaeriidae | | | | x | x | x | x | x |
| Trichoptera | | x | x | x | x | x | x | |
| Turbellaria | | | | | | x | | |
| Zygoptera | | x | | x | | x | x | x |
| Other | | x | | | x | | x | x |
| Total No. Taxa | | 9 | 9 | 13 | 12 | 23 | 15 | 14 |

Table 2
TONAWANDA CREEK MAJOR TAXA FROM PONAR SAMPLES
(no. of organisms collected per m$^2$)

| Major Taxa | Station 1 | | Station 2 | | Station 3 | | Station 4 | | Station 5 | | Station 6 | | Station 7 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | A | B | A | B | A | B | A | B | A | B | A | B |
| Amphipoda | | | | | | | | 38 | 227 | 2514 | | | | |
| Coleoptera | 19 | | | | | | 19 | 19 | | 359 | | 19 | 13 | |
| Diptera | 57 | 189 | | | 265 | 95 | 737 | 151 | 170 | 1323 | 170 | 1172 | 101 | 162 |
| Ephemeroptera | 57 | | | | | | | | | | | 38 | | |
| Gastropoda | | | | | | | | | 189 | 794 | | | | |
| Hemiptera | | | | | | | | | | 95 | | | | |
| Hirudinea | | | | | | | | | 38 | 19 | | | | |
| Hydracarina | | | | | | | | | | 19 | | | | |
| Isopoda | | | | | | | | | 95 | 4082 | | | | |
| Lepidoptera | | | | | | | | | | 19 | | | | |
| Megaloptera | | | | | | | | | 19 | 19 | | | 19 | |
| Nematoda | | | | | 38 | | 38 | | | 435 | 19 | | 6 | |
| Oligochaeta | 113 | 227 | | | 618 | 756 | 4158 | 3478 | 302 | 3100 | 19 | 38 | 126 | 10 |
| Pelecypoda | | | | | 38 | 19 | 76 | 57 | | 302 | 38 | | | |
| Trichoptera | 19 | | | | | | | 19 | 95 | | 19 | 19 | 19 | |
| Turbellaria | | | | | | | | | | 19 | | | | |
| Total No. Taxa | 5 | 2 | | | 4 | 3 | 5 | 6 | 8 | 14 | 5 | 5 | 6 | 2 |

A = Grab Sample #1 B = Grab Sample #2

Table 3
TONAWANDA CREEK MAJOR TAXA
FROM D-FRAME AQUATIC NET SAMPLES
(no. of organisms collected per $m^2$)

| Major Taxa | Stations 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Amphipoda | 19 | | 3 | 2 | 206 | | 32 |
| Anisoptera[A] | | | | | 3 | 1 | 1 |
| Ceratopongonidae | | 5 | | | 4 | | |
| Chironomidae | 115[C] | 53 | 8[E] | 19 | 37 | 3 | 10 |
| Coleoptera | 2 | 9[D] | 3[D] | | 11 | | 3[F] |
| Corixidae[A] | | 7[D] | | | 10 | 1 | 3[D] |
| Decapoda | | | | 3 | 3 | | |
| Diptera[B] | | | 3 | | | | |
| Ephemeroptera | 27 | 12 | 1 | 22 | 5 | 1 | |
| Gastropoda | | | | | 97 | | 6 |
| Gerridae[A] | | | 1 | | | | |
| Isopoda | | 1 | 1 | 2 | 55 | 1 | 4 |
| Lepidoptera | | | | | | | |
| Megaloptera | | | | | 2 | | 3 |
| Nepidae[A] | | | | | | | 1 |
| Oligochaeta | 88[C] | 6 | 4 | 3 | 1 | 5 | 17 |
| Simuliidae | 1 | 2 | 152[E] | 9 | 3 | 6 | |
| Sphaeriidae | | | 2 | 2 | 8 | 2 | 2 |
| Tabanidae | | | | | 1 | 4 | |
| Trichoptera | 11 | 9 | 2 | 9 | 5 | 3 | |
| Zygoptera[A] | 3 | | 1 | | 11 | 1 | 6 |
| Other | 1 | | | 1 | | 1 | 1 |

A - Aquatic, but generally not considered benthic
B - Does not include subordinate taxa included in the table
C - All organisms of the taxon not picked from the sample
D - Includes adults and nymphs
E - Includes larvae and pupae
F - Includes adults only

## Table 4
## DETAILED IDENTIFICATION OF PONAR GRABS
### (mean numbers of organisms per m²)

| Stations | 1 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| AMPHIPODA | | | | | | |
| Talitridae | | | | | | |
| *Hyalella azteca* | | | 19 | 1370 | | |
| COLEOPTERA | | | 9 | 180 | 9 | |
| Elmidae | | | | 9 | | 57 |
| *Narpus* sp. | 9 | | 9 | | | |
| DIPTERA | | | 9 | | | |
| Ceratopogonidae | | | | 236 | | |
| Chironomidae | | 9 | 19 | 38 | 142 | 104 |
| Tanypodinae (SF) | | | | | | |
| *Ablabesmyia* sp. | | | | | 9 | 28 |
| *Clinotanypus* sp. | | | | 85 | | |
| *Procladius* sp. | | | | 95 | | |
| *Tanypus* sp. | 9 | | | | | |
| Chironominae (SF) | | | | | | |
| Chironomini (TRIBE) | 9 | 19 | | 19 | 19 | 28 |
| *Cryptochironomus* sp. | | 28 | 9 | | 9 | 28 |
| *Dicrotendipes* sp. | | | | | | 57 |
| *Glyptotendipes senilis* | 9 | | | | | |
| *Microtendipes* sp. | | 9 | 9 | 85 | | 113 |
| *Paralauterborniella* sp. | | 38 | | | | |
| *Polypedilum* sp. | 66 | 57 | 378 | 19 | | 28 |
| *Pseudochironomus* sp. | | | | | | 19 |
| *Tribelos* sp. | | | | 85 | | |
| Tanytarsini (TRIBE) | 19 | | | 47 | 123 | 19 |
| *Micropsectra* sp. | | | | 9 | | 28 |
| Orthocladiinae (SF) | | 9 | 9 | 9 | 170 | 227 |
| *Brillia* sp. | | | | 9 | 104 | |
| *Cricotopus* sp. | 9 | | | | 47 | 77 |
| *Eukiefferiella* sp. | | | | | 9 | |
| *Thienemanniella* sp. | | 9 | | | 28 | |
| *Trichocladius* sp. | | | | | 19 | |
| Simuliidae | | | | | | 19 |
| Tabanidae | | | 9 | 9 | | |
| EPHEMEROPTERA | | | | | 19 | |
| Ametropodidae | | | | | | |
| *Siphloplecton* sp. | 9 | | | | | |
| Caenidae | | | | | | |
| *Caenis* sp. | 9 | | | | | |
| Heptageniidae | | | | | | |
| *Stenonema* sp. | 9 | | | | | |

Table 4 continued
DETAILED IDENTIFICATION OF PONAR GRABS
(mean numbers of organisms per $m^2$)

| Stations | 1 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| GASTROPODA | | | | | | |
| Amnicolidae | | | | | | |
| *Amnicola* sp. | | | | 47 | | |
| *A. limosa* | | | | 397 | | |
| Planorbidae | | | | 9 | | |
| Viviparidae | | | | | | |
| *Viviparus georgianus* | | | | 38 | | |
| HEMIPTERA | | | | | | |
| Corixidae | | | | 28 | | |
| Gerridae | | | | | 19 | |
| HIRUDINEA | | | | 28 | | |
| HYDRACARINA | | | | 9 | | |
| ISOPODA | | | | | | |
| Asellidae | | | | | | |
| *Asellus* sp. | | | | 1455 | | |
| *A. racovitzai racovitzai* | | | | 633 | | |
| LEPIDOPTERA | | | | 9 | | |
| MEGALOPTERA | | | | | | |
| Sialidae | | | | | | |
| *Sialis* sp. | | | | 19 | | 28 |
| NEMATODA | | 19 | 19 | 217 | 9 | 28 |
| OLIGOCHAETA | | | | | 19 | |
| Naididae | | | | 38 | | |
| *Nais* sp. | 9 | | | | | |
| *Ophidonais serpentina* | | | | | | 28 |
| *Specaria josinae* | 9 | | | | | |
| Tubificidae | | | | | | |
| Immature without hair setae | 95 | 1040 | 1361 | 397 | 9 | 142 |
| Immature with hair setae | | 47 | 198 | 869 | | 142 |
| *Aulodrilus pigueti* | | | | | | 19 |
| *A. pluriseta* | 9 | | | | | 170 |
| *Ilyodrilus templetoni* | | | 19 | 255 | | |
| *Limnodrilus* sp. | | | 397 | 19 | | 57 |
| *L. claparedeanus* | 28 | 1143 | 501 | | | |
| *L. hoffmeisteri* | 19 | 416 | 1276 | 57 | | 28 |
| *L. udekemianus* | | 76 | | | | |
| *Peloscolex ferox* | | 586 | | 19 | | |
| *Tubifex tubifex* | | 161 | 66 | 38 | | |
| PELECYPODA | | | | | | |
| Sphaeriidae | | | 28 | | | |
| *Pisidium* sp. | | 9 | 28 | 151 | | |
| *Sphaerium rhomboideum* | | 19 | | | | |
| *S. striatinum* | | | 9 | | 19 | |

Table 4 concluded
DETAILED IDENTIFICATION OF PONAR GRABS
(mean numbers of organisms per m²)

| Stations | 1 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| TRICHOPTERA | | | | 19 | | 57 |
| Hydropsychiidae | | | | | 9 | |
| *Cheumatopsyche* sp. | | | | | 9 | |
| *Hydropsyche* sp. | 9 | | | | | |
| Limnephilidae | | | | | | |
| *Pycnopsyche* sp. | | | 9 | | | |
| Psychomyiidae | | | | 28 | | |
| *Polycentropus* sp. | | | | 66 | | 28 |
| TURBELLARIA | | | | 9 | | |

25 February 1976. At that time it was noted that thousands of mayfly larvae (Ephemeroptera) were in 5 cm or less of water all along the creek bank. It is believed that some movements by the benthic macroinvertebrates towards the banks and slower or "cleaner" water was at least in part responsible for the collection of larger numbers of taxa with the D-Frame aquatic net than with the Ponar Dredge. Other factors that could be partly responsible are the inherent characteristics of the Ponar Dredge and the ability to sample more than one habitat condition with the D-Frame net.

Despite the stress on the benthic habitat at the time of sampling, a relatively wide diversity of benthic macroinvertebrates were collected from the Tonawanda Creek. It was noted that from the Little Tonawanda Creek, which did not appear to be under as much physical stress at the time of sampling, a considerably larger and more diverse zoobenthic fauna was collected. Whether this greater diversity was solely due to the physical conditions of the stream at the time of sampling, or in part or whole to other factors such as less organic enrichment, is unknown.

In both the Tonawanda and Little Tonawanda Creeks, the benthic macroinvertebrates collected were primarily indicative of relatively unpolluted stream conditions. The percentage of organisms in the family Tubificidae in the

## DISCUSSION

At the time of sampling, the Tonawanda Creek area appeared to be a relatively fast-flowing, heavily silt-laden stream. The banks showed signs of heavy erosion. The depth of the stream was still above its summer level. Terrestrial vegetation was still submerged in places.

There were no pools noted along the stream except for Station 3 where a fallen tree had created a pool situation near the embankment. The current of the stream prevented siltation in the center of the channel at all stations examined from the bridge. It was assumed that this held true for the stream throughout the study area.

The Little Tonawanda Creek appeared to be a slower-flowing stream than Tonawanda Creek at the time of sampling. There were considerable amounts of emergent and submergent aquatic vegetation in the vicinity of Station 5. The central channel of this stream was rocky. However, this bottom condition did not extend as far toward the banks as it did at the majority of the sampling areas on the Tonawanda Creek.

It is believed that the condition of the Tonawanda Creek at the time of sampling forced portions of the benthic fauna to seek shelter in areas of slower current, such as under or around large rocks or closer to the stream shore out of the silt-laden water. This was perhaps best exemplified at Station 3 when it was first visited on

total benthic macroinvertebrate population from the Ponar grab samples was over 80% at only two stations (Station 3A, 94.8%; 3B, 87.0%; 4A, 82.7% and 4B, 92.5%). The next highest number, 54.6%, was noted at Station 1B. According to the method established by Goodnight (1960), if the bottom population of tubificids is over 80% of the total population, heavy organic pollution is indicated. If, however, the population is from 60-80%, the condition of the stream may be considered as moderately polluted. A tubificid population of less than 60% of the total macroinvertebrates indicates that the stream is relatively unpolluted. At the stations where heavy pollution was suspected, identification of the Tubificidae was attempted. Nearly all of the mature worms identified from the four samples at Stations 3 and 4 were either of the pollution-tolerant *Limnodrilus* genus (Brinkhurst 1967) or *Tubifex tubifex*, which is also commonly associated with a high degree of organic pollution (Brinkhurst and Jamieson 1971). On the other hand, both Stations 3 and 4 contained average numbers of major taxonomic groups (13 and 12, respectively). Some of these taxa, such as Amphipoda and Ephemeroptera, generally are indicative of less polluted conditions. At the other collection sites it was concluded on the basis of an examination of the benthic macroinvertebrates that the Tonawanda and Little Tonawanda Creeks were, at the time of sampling, relatively unpolluted

and productive streams. The populations of organisms present could support a "clean" water fishery.

## CONCLUSIONS - RECOMMENDATIONS

To establish the Batavia Reservoir Compound, it is anticipated that the present lotic environment in the study area, which has a relatively diverse zoobenthic population, would be displaced. In its place a larger lentic environment would be created. Because this lentic environment could be subjected to siltation and accumulation of organically rich run-off from upstream sources, the benthic population could be dominated by organisms tolerant to this type situation. To prevent such a problem from occurring as well as promote the establishment of organisms that comprise the diet of a more desirable sports fishery, care will have to be exercised in the management of the impounded watershed.

The removal of bottom material at Stations 3 and 4 would not have a markedly negative impact on the ecology of the stream. On the contrary, such excavation could decrease stress on the stream due to the present sediment dissolved oxygen demand.

## SELECTED REFERENCES

Brinkhurst, R. O. 1967. The distribution of aquatic oligochaetes in Saginaw Bay, Lake Huron. Limnol. Oceanogr. (12) 137.

Brinkhurst, R. O. and B. G. M. Jamieson. 1971. Aquatic Oligochaeta of the World. Univ. Toronto Press. 860 p.

Goodnight, C. J. 1960. Oligochaetes as indicators of pollution. Proc. 15th Annual Waste Conf. Purdue Univ. Eng. Ext. Serv. 106(45):139-142.

APPENDIX A
BIOLOGICAL STUDIES AND FISH AND WILDLIFE COORDINATION

SECTION A-5
AQUATIC INSECT STUDY

Aquatic Insects of Tonawanda Creek

Imagoes of aquatic insects inhabiting Tonawanda Creek were sampled at two locations on two occassions during the Spring and Summer of 1979. Knowledge of the insect fauna of the creek is important because of both the value of the invertebrates as part of the food chain and of their value as indicators of water quality. It was decided to sample adult insects rather than larvae, which is the more common practice, because they lend themselves to more exact identification.

Insects were collected by means of a light trap. This consisted of a fluorescent lantern set in a bucket containing a small quantity of alcohol. The trap was set out for one hour beginning at sunset. Insects were attracted to the light and some of them fell into the alcohol. Additional insects were collected by sweep net from the swarms that formed by the light. Station 1 (see map) was sampled the evenings of 4 June and 17 July. Site 2 (see map) was sampled on 6 June and 30 July.

The majority of insects collected belonged to one of three orders: Ephemeroptera (mayflies), Trichoptera (caddisflies), and Diptera (true flies). Table 1 lists the insects collected. Insects of the orders Odonata and Plecoptera were seen but not collected. Due to the complex taxonomy of the Diptera detailed identification of that group was not attempted. Light trapping is not a quantitative method, but should reflect the relative abundance of insects. Numerically, midges (Diptera: Chironomidae) were clearly most common while mayflies and caddisflies seemed equal in abundance. In addition, each order of insects was represented by a variety of species.

Caddisflies of several families were collected at Tonawanda Creek. Taxa from each sampling site were essentially the same. The variety of taxa in general indicates good water quality for the creek. The Hydropsychidae, among the more pollution-tolerant families, was represented by two species, while Leptoceridae, whose members normally inhabit clean, cool streams, was represented by several species. Hydroptila waubesiana, family Hydroptilidae, is also cited from clear streams (Ross, 1944).

Mayflies are found in a variety of habitats, but are usually absent from severely polluted waters. Stenonema and Baetes, however, are believed to tolerate a wide range of ecological conditions (Roback, 1974.)

True flies are a wide-ranging order found in virtually every sort of habitat from sewage treatment ponds to pristine waters. Common aquatic families include mosquitoes, crane flies, and midges, all of which were collected at Tonawanda Creek.

The fact that a diversity of insects representing several orders was collected from Tonawanda Creek is indicative of a healthy, productive ecosystem. Since sampling effort was not very extensive it is likely that other insects, either rare or with very early or late season emergence periods, may be found in the creek. The wide diversity of insects, each inhabiting a different substrate or creek area should provide a solid base for the food chain in Tonawanda Creek.

Literature Cited

Roback, S., 1974. "Insects In Pollution Ecology of Aquatic Invertebrates." Edited by Hart and Fuller, Academic Press, NY, 389 ppg.

Ross, H. H., 1944. "The Caddis Flies, or Trichoptera, of Illinois." Illinois Natural History Survey, Urbana, IL. (Printed by Entomological Reprint Specialists, 1972) 336 ppg.

Table 1 - Aquatic Insects Collected at Tonawanda Creek, NY*

Ephemeroptera:

Baetidae

*Baetis* sp.

Heptageniidae

*Stenonema* sp.
*Epeorus* sp.

Caenidae

*Caenis* sp.
Leptophebiidae
*Paraleptophlebia* sp.

Trichoptera:

Polycentropodidae

*Neureclipsis bimaculata*
*N. crepuscularis*
*Nyctiophylax* sp.

Hydropsychidae

*Cheumatopsyche* sp.
*Hydropsyche* sp.

Hydroptilidae

*Hydroptila waubesiana*

Rhyacophiloidae

*Protoptila* sp.

Leptoceridae

*Ceraclea tarsi-punctatus*
*Nectopsyche exquisita*
*N.* spp.
*Oecetis inconspicua* *O. rocturna*
*Triaenodes tarda*
*Leptocerus americanus*

*Identifications were checked by Dr. R.J. Neves, VCFRU, VPI & SU.

Table 1 - Aquatic Insects Collected at Tonawanda Creek, NY (Cont'd)

Psychomycidae

*Psychomyia* sp.

Diptera:

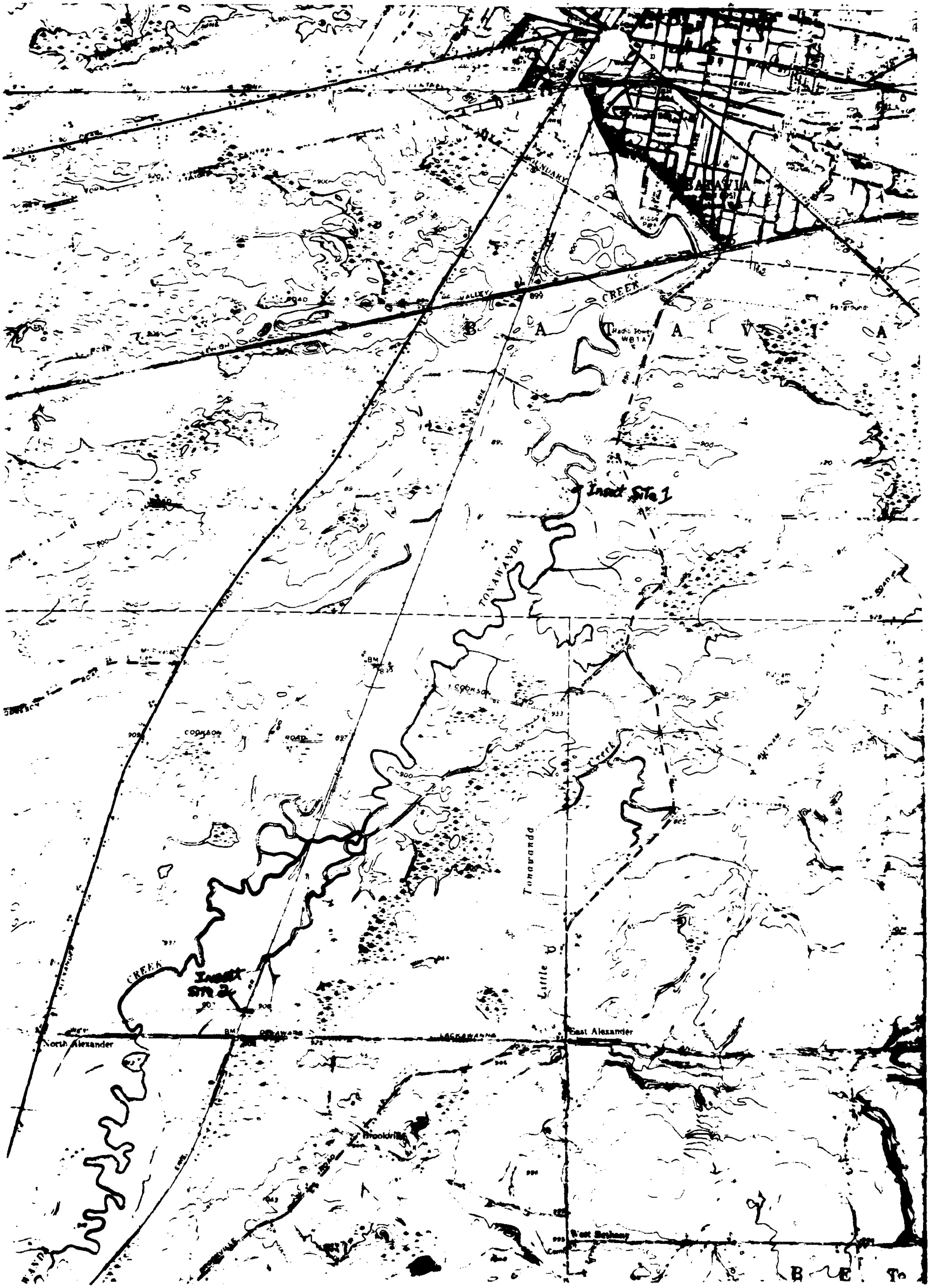
Tipulidae

*Tipula* spp.

Chironomidae

*Tanytarsus* spp
*Orthocladius* spp.
*Chironomus* spp.
*Glyptotendipis* spp.
*Brillia* spp.

Culicidae



B A T A V I A
CREEK
Radio Tower WBTA
Insect Site 1
TONAWANDA
COOKSON ROAD
Insect Site 2
CREEK
Little Tonawanda Creek
North Alexander
East Alexander
LACKAWANNA
Brookville
West Bethany
B E T

# APPENDIX A
# BIOLOGICAL STUDIES AND FISH AND WILDLIFE COORDINATION

## SECTION A-6

## FISH AND WILDLIFE MITIGATION ANALYSIS

TONAWANDA CREEK
MITIGATION ANALYSIS

## 1. INTRODUCTION

1.01 Purpose - The purpose of this appendix to the Tonawanda Creek Final Feasibility Report is to provide an analysis of the Buffalo District's position on fish and wildlife mitigation for the proposed Tonawanda Creek Regional Flood Control Project. Therefore, some of the material presented here has been incorporated into the main text of both the Final Feasibility Report and the Final Environmental Impact Statement.

1.02 Organization - This appendix is divided into five distinct sections; the first of which is this introduction. The second section briefly discusses the Corps of Engineers and U. S. Fish and Wildlife Service's policies on mitigation, particularly as such policies apply to the Tonawanda Creek study. The third section briefly describes the U. S. Fish and Wildlife Services Habitat Evaluation Procedures (HEP) as they were used to make mitigation determinations for the project and the various assumptions used by the Fish and Wildlife Service in making recommendations for mitigation. The fourth section presents an independent Corps of Engineers analysis of the fish and wildlife habitat impacts that would occur with construction and operation of the Batavia Reservoir (Modified) Plan. The fifth section presents the Buffalo District's position on mitigation for the proposed project and a recommendation for mitigation for the Tonawanda Creek project.

## 2. U. S. FISH AND WILDLIFE SERVICE AND CORPS OF ENGINEERS POLICIES ON MITIGATION

2.01 U. S. Fish and Wildlife Service - The purpose of this section is to briefly contrast the U. S. Fish and Wildlife Service and the U.S. Army Corps of Engineers policies on mitigation of adverse effects of water resources development projects on fish and wildlife resources. The U.S. Fish and Wildlife Service's policy on mitigation is described in a notice of final policy entitled "U. S. Fish and Wildlife Mitigation Policy" as published in the Federal Register. 1/ Although the Fish and Wildlife Coordination Act Report for the Tonawanda Creek study predates this policy publication, the general U.S. Fish and Wildlife Service Policy for recommending mitigation as described in the policy paper appears to apply to the Tonawanda Creek project. Section V of the final policy states that "In the interest of serving the public, it is the policy of the U.S. Fish and Wildlife Service to seek to mitigate losses of fish wildlife, their habitats, and uses thereof from land and water development." Compensation, as a form of mitigation, is defined in the policy statement as "when used in the context of Service mitigation recommendations, means full replacement (underlining added) of project-induced losses to fish and wildlife resources, provided such full replacement has been judged by the Service to be consistent with the appropriate mitigation planning goal."

2.02 With the exception of Resource Category 4, as defined in the policy statement, it is generally the policy of the U.S. Fish and Wildlife Service to recommend ways to minimize losses. If losses are still likely to occur, it is the policy of the U.S. Fish and Wildlife Service to recommend compensation for such losses. For Resource Category 4, where habitats are of medium to low value to evaluation species, it is the policy of the U.S. Fish and Wildlife Service to recommend ways to minimize loss of habitat value. If losses are still likely to occur then the policy states that "... the service may not (underlining added) make a recommendation for compensation depending upon the significance of potential loss." It can generally be stated that the U.S. Fish and Wildlife Services Policy is that all habitat and fish and wildlife resources losses should be mitigated for in one manner or another.

2.03 Corps of Engineers - The Corps of Engineers policy on mitigation is defined in Engineer Regulation 1105-2-50. 2/ The Corps authority for mitigation of fish and wildlife resource losses in water resources projects arises from the Fish and Wildlife Coordination Act. The Act states that "fish and wildlife conservation shall receive equal consideration with other project purposes." The Fish and Wildlife Coordination Act authorizes the inclusion in water resource development plans measures to offset losses or damages to fish and wildlife resources.

2.04 In general, Corps policy is that damages to or losses of significant fish and wildlife resources be avoided or minimized to the extent practicable, and that unavoidable damages and losses be compensated to the extent justified. Significant resources include, but are not limited to, those resources identified in the laws, regulations, guidelines or other institutional standards of

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national, regional and local public agencies, and certain private groups. The extent of, and justification for, mitigation of adverse effects of an alternative plan shall be based upon the significance of the resulting losses, compared to the combined monetary and non-monetary costs required to carry out the mitigation measures.

1/ Federal Register. Notice of Final Policy. U.S. Fish and Wildlife Service Mitigation Policy. 23 January 1981. Vol. 46, No. 15, pages 7644-7663.

2/ ER 1105-2-50, dated 29 January 1982, Environmental Resources.

2.05 Comparison of Policies - In general, Corps of Engineers and U.S. Fish and Wildlife Service policies are quite similar. However, justifying criteria for determining mitigation to be recommended can be quite different depending upon how the various policy statements of the two agencies are interpreted. U.S. Fish and Wildlife Policy for determination of mitigation needs is based primarily, and in most cases almost exclusively on the value of the resource lost. Corps policy is similar in this respect but must also consider the costs (monetary, social, and environmental) in making a determination if mitigation is warranted for a water resource development project. Mitigation is, therefore, only a part of the entire project evaluation in Corps projects and when making trade-off decisions for the project cannot be made a separable feature of the project, justifiable in itself, without the consideration of other project aspects.

## 3. U. S. FISH AND WILDLIFE SERVICE RECOMMENDED MITIGATION

3.01 The final Fish and Wildlife Coordination Act Report for the Tonawanda Creek Study, dated 23 October 1980 (see Appendix G, Final Feasibility Report) recommended mitigation of the predicted adverse fish and wildlife impacts of the project based upon a Habitat Evaluation Procedure (HEP) study of the project area. Field work for the study was conducted by personnel of the U. S. Fish and Wildlife Service, New York State Department of Environmental Conservation and the Buffalo District. The mitigation recommended by the U. S. Fish and Wildlife Service is based upon the estimated habitat unit changes that will occur if the Batavia Reservoir Compound (Modified) Plan is constructed.

3.02 A number of assumptions were used in the HEP analysis which affect the mitigation acreages determined. The most important assumptions are:

a. That 35 percent of the upper floodpool lands and 5 percent of the lower floodpool lands would develop into unstable mudflats under the with-the-project conditions and that all mudflats would form within the first 25 years of project life.

b. That all habitat types would be equally affected by mudflat formation, except that emergent marshland in the lower floodpool would remain unaffected (0 percent loss) and that cropland in the upper floodpool would be severely affected (60 percent loss).

c. That the mudflats would have little or no wildlife value (HSI = 0.000).

3.03 Originally the U. S. Fish and Wildlife Service recommended that several wetland complexes in both the upper and lower floodpools be protected from complete inundation by the construction of lateral dikes and flapgates. Due to the high cost of such a dike in the upper floodpool, the Buffalo District asked U. S. Fish and Wildlife Service to consider the possibility of in-kind compensation for the purported loss of a large wetland area in the upper floodpool. Subsequently, the U. S. Fish and Wildlife Service recommended that another equally valuable wetland complex, outside the maximum floodpool boundaries, be obtained for compensation and managed for fish and wildlife purposes. This area would be about 112 acres in size and would compensate for the loss of 37 acres of emergent marsh and 75 acres of shrub swamp in the upper floodpool.

3.04 The U. S. Fish and Wildlife Service also recommended that projected habitat unit losses be compensated for by the purchase and management of habitat outside the maximum floodpool boundaries. As much of the projected habitat loss was in high value cropland, U. S. Fish and Wildlife Service and the Buffalo District agreed that projected cropland losses should be converted to out-of-kind (substituting different habitat types for those lost) compensation in the form of shrub swamp and forested wetland. As shrub swamp and forested wetland have a higher habitat suitability index (HSI) than cropland, this conversion reduced both the total amount of compensation acreage required and the cost of obtaining such acreage. The total amount of out-of-kind compensation recommended was 78 acres of shrub swamp and 475 acres of forested wetland.

3.05 Therefore, the total amount of compensation lands recommended by the U. S. Fish and Wildlife Service is 665 acres (475 acres of forested wetland, 153 acres of shrub swamp, and 37 acres of emergent marsh).

3.06 The Corps of Engineers has had difficulties accepting the U.S. Fish and Wildlife Service's recommendations for mitigation based upon the HEP analysis. The problems are related not to the actual HEP analysis itself but rather to several assumptions made in conducting the analysis. One major assumption made in the Fish and Wildlife Service mitigation analysis is that 35 percent of the upper floodpool lands and 5 percent of the lower floodpool lands would turn into unstable mudflats during the first 25 years of the project lifetime. The HEP analysis has further assumed that all habitat types would be equally affected by mudflat formation, with certain exceptions. This assumption that mudflats will form is the entire basis outside of outright construction impacts, for determining how much acreage of the various habitat types, will be affected. From this the total amount of mitigation required is determined in the HEP analysis.

3.07 The Buffalo District has concluded that sedimentation will be a minor insignificant problem within the Batavia Reservoir Compond (see paragraph 4.16 to 4.18 of this input). This determination contradicts the assumption made in the HEP analysis and renders the results of the HEP analysis invalid. Therefore, it is the Corps of Engineers contention that the 665 acres of mitigation acreage recommended in the Fish and Wildlife Coordination Act Report is incorrect.

3.08 *In response to the problem* with the Fish and Wildlife Coordination Act Report the Buffalo District prepared a separate non-HEP analysis of mitigation requirements for the Tonawanda Creek study. The following section presents the results of this analysis.

4. ANALYSIS OF IMPACTS OF CONSTRUCTION AND OPERATION

4.01 Introduction. This section provides the Buffalo District's analysis of the predicted habitat impacts of the construction and operation of the Batavia Reservoir Compound (Modified) Plan. It is based upon the habitat types described in the U. S. Fish and Wildlife Service Coordination Act Report1/ and the construction features and operational plan developed for the reservoirs as described in the Final Feasibility Report for Tonawanda Creek.

4.02 Originally the Buffalo District considered doing a User-Day Analysis of the impacted project area. As discussed in Earls (1981) 2/ a user-day analysis is a type of analysis that quantifies the economic damage and/or benefits that will occur to fish and wildlife resources if a project is implemented. Losses and/or gains is to fish and wildlife resources causing a reduction and/or increase in recreational hunting and fishing opportunities are evaluated in the same way as other forms of recreation and included in the NED account. The New York State Department of Environmental Conservation (NYSDEC) though operating much of the project area as cooperative hunting and fishing areas had no data on hunting and fishing pressures in the area that could be used in a user-day analysis. In addition, variable, intermittent posting of private lands for hunting and fishing within the project boundaries make it impossible to determine how much land is open and available for hunting and fishing. For these reasons the Buffalo District considered it impractical to do a user-day analysis on the project.

4.03 The analysis presented here is based upon the predicted construction and operational impacts of the Batavia Reservoir Compound (Modified) and is an in-kind habitat replacement type of analysis.

CONSTRUCTION IMPACTS

4.04 Construction of Embankments, Outlet Works, and Training Dikes. Construction of both the upper dam (embankment and outlet works) and the lower dam (embankment and outlet works) as well as the training dikes for the lower reservoir will result in the outright loss of a number of acres of various habitat types. A compilation of the estimated habitat losses that will result with construction of the project are presented in Table 4.1. As indicated in the table, the total predicted loss is about 115 acres of which about 66.1 acres (57 percent) is cropland. Lesser amounts of pasture, shrub swamp, forested wetland and emergent marsh will also be lost with construction of the project.

4.05 Impacts of Clearing and Snagging - The existing Tonawanda Creek channel within the limits of both the upper and lower reservoir pools will be cleared of snags and debris jams. Dead trees along the streambanks and overhanging, partially uprooted trees will also be removed. This clearing

1/ Final Feasibility Report, Appendix G.

2/ Earls, Gary A. (1981). Traditional Analysis Fish and ..ldlife Approaches Used in the Corps. Planning Associates Program: 1980-1981 Board of Engineers for Rivers and Harbors, Fort Belvoir, VA, 71 pp.

Table 4.1 - Tonawanda Creek, New York - Habitat Loss in Acres from Construction of the Batavia Reservoir Compound (Modified)

| Habitat Type 1/ | Habitat Losses | | | |
|---|---|---|---|---|
| | Upper Reservoir | Lower Reservoir | Training Dikes | Total |
| Forested Wetland | 3.1 | 1.6 | 3.8 | 8.5 |
| Cropland | 25.0 | 24.9 | 16.2 | 66.1 |
| Pasture | - | 4.8 | - | 4.8 |
| Shrub Swamp | 14.1 | 13.7 | - | 27.8 |
| Emergent Marsh | 7.8 | - | - | 7.8 |
| Totals | 50.0 | 45.0 | 20.0 | 115.0 |

1/ The habitat types are those described in the U. S. Fish and Wildlife Service Final Fish and Wildlife Coordination Act Report, dated 23 October 1980 (Appendix G, Final Feasibility Report).

and snagging encompasses a total stream length of about 13 miles (8 miles lower reservoir and 5 miles upper reservoir). The entire area along these streambanks is composed of forested wetland habitat type as described in the U. S. Fish and Wildlife Service Coordination Act Report. It is estimated, based upon an impacted area 13 miles long and 100 feet wide, that the total amount of forested wetland effected is 158 acres.

## OPERATIONAL IMPACTS

4.06 Introduction - Operation of the Batavia Reservoir Compound (Modified) will create temporary impoundments of floodwaters in both the upper and lower reservoir pool areas. Such containment of flood waters could create conditions under which the naturally occurring vegetation in both reservoir storage areas could be impacted. The next few pages of this appendix will present the Buffalo District's analysis of the possible operational effects of the Batavia Reservoir Compound (Modified) on the various habitat types present within the reservoir floodpools. Again, the habitat types are those discussed in the U. S. Fish and Wildlife Service Coordination Act Report. The regulation of the reservoirs is as presented in the Hydrology and Hydraulics Appendix of the Final Feasibility Report for Tonawanda Creek.

## RESPONSES OF PLANTS TO FLOODING

4.07 Potential Effects of Flooding on Plants - Several recent publications have reviewed considerable literature and research on the responses of vegetation, particularly woody vegetation, to intermittent flooding. Teskey and Hinckley (1977)[1/] give a good review of both short-term and long-term impacts of flooding on vegetation. Physiological responses of plants to stresses induced by flooding are reviewed in Teskey and Hinckley (1977) and in more detail in Whitlow and Harris (1979)[2/]. It is not the purpose of this discussion to review this literature on plant physiology. The interested reviewer should refer to the cited publications. However, as described in Teskey and Hinckley (1977), there appears to be five major physical factors which are critical in determining plant responses to changes in water level. These physical factors are described in the following paragraphs.

4.08 Time of Year - The particular time of year a flood occurs appears to be a critical factor in determining the growth and survival of a plant species exposed to flooding. For most bottomland tree species, flooding during the dormant season has few if any adverse effects on mortality.

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1/ Teskey, Robert O., and Thomas M. Hinckley, 1977. Impact of Water Level Changes on Woody Riparian and Wetland Communities, Volume 1: Plant and Soil Responses to Flooding, U. S. Fish and Wildlife Service, Office of Biological Services. FWS/OBS-77/58, 30 pp.

2/ Whitlow, Thomas H., and Richard W. Harris, 1979. Flood Tolerance in Plants: a State-of-the-Art review, U. S. Department of the Army, Waterways Experiment Station, TR E-79-2. 161 pp. plus Appendix.

However, flooding or high water tables extending into the growing season can have serious effects. Along with time of the year, water temperature appears to effect the survival of plants exposed to flooding. Warm water is more damaging to tree survival than cool water.

4.09 Flood Frequency - There is no consensus on the effects of flood frequency. However, it appears that as flood frequency decreases, herbaceous understory vegetation increases in diversity. Flood frequency is very important in the establishment of trees, but appears to be less important than the timing and duration of flooding for mature woody vegetation.

4.10 Flood Duration - The duration of flooding is very important in determining the survival of a species exposed to intermittent flooding. Trees flooded for durations of less than 1 month at the beginning of the growing season are often damaged, the amount of damage being related to the flood tolerance of the species. Recovery is often rapid if the tree does not die before the flood waters recede. Long-term flooding, especially during the growing season, causes considerably higher mortality. However, many species are highly flood tolerant and can survive flooding for a period of 1 or more years.

4.11 Water Depth - The depth of flooding is another important factor in determining the responses of woody vegetation to flooding. It is particularly important for seedlings and herbaceous vegetation as they will often be completely covered by water. However, dormant seedlings will often survive flooding, remaining dormant while covered with water, and leaf out after the flood waters recede.

4.12 Siltation - Flood waters depositing heavy loads of silt affect plant growth and survival, however, many species are somewhat resistant to damage from siltation.

IMPACT ANALYSIS

4.13 Basis of Analysis - For this purpose of this impact analysis, the operating plans of both the upper and lower reservoirs were considered in developing this analysis. As illustrated in Table 4.2 for the lower reservoir, operating the reservoir to control the 2-year frequency flood actually creates the greatest flooding changes (thus impacts) from the flooding that naturally occurs in the reservoir pool area. This discussion concerns only flooding within the reservoir floodpools and not downstream flooding. As indicated in the third column of Table 4.2, for the 2-year flood, the elevation of flooding in the pool would be increased by 6.2 feet, the area flooded by 610 acres, and the duration of flooding by 7.4 days. For the less frequent floods, the elevation and duration of flooding are increased but to a lesser magnitude than for the 2-year flood. The area flooded at maximum pool actually decreases for the more frequent floods as waters that would normally spread into low lying areas near the pool margins are contained within the pool by the dam and lateral dikes.

Table 4.2 - Tonawanda Creek, New York - Lower Reservoir, Pool Elevations, Acreage Flooded, and Duration of Pool Flooding Under Natural and Improved Conditions

| Flood Frequency | Natural Conditions | | | Improved Conditions | | | Change (From Natural to Improved Conditions) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Maximum Pool Elevation (feet) | Area Flooded at Maximum Pool (acres) | Duration of Pool Flooding (days) | Maximum Pool Elevation (feet) | Area Flooded at Maximum Pool (acres) | Duration of Pool Flooding (days) | Maximum Pool Elevation (feet) | Area Flooded at Maximum Pool (acres) | Duration of Pool Flooding (days) |
| 2-Year | 891.8 | 1,340 | 2.4 | 898.0 | 1,950 | 9.8 | +6.2 | +610 | +7.4 |
| 10-Year | 893.9 | 1,850 | 3.0 | 895.1 | 1,220 | 5.1 | +1.2 | -630 | +2.[illegible] |
| 20-Year | 894.6 | 2,020 | 3.3 | 895.9 | 1,400 | 6.8 | +1.3 | -620 | +3.5 |
| 50-Year | 895.4 | 2,250 | 4.3 | 897.3 | 1,750 | 8.1 | +1.9 | -500 | +3.8 |
| 100-Year | 895.8 | 2,350 | 4.9 | 898.3 | 2,020 | 8.3 | +2.5 | -330 | +3.4 |
| 200-Year | 896.2 | 2,470 | 7.3 | 899.2 | 2,300 | 9.8 | +3.0 | -170 | +2.5 |
| 500-Year | 896.7 | 2,620 | 8.6 | 900.0 | 2,560 | 10.8 | +3.3 | - 60 | +2.2 |
| SPF | 902.0 | 5,150 | 15.5 | 902.5 | 3,050 | 15.5 | +0.5 | -2,100 | 0.0 |

Table 4.3 - Tonawanda Creek, New York - Upper Reservoir, Pool Elevations, Acreage Flooded, and Duration of Pool Flooding Under Natural and Improved Conditions

| Flood Frequency | Natural Conditions | | | Improved Conditions | | | Change (From Natural to Improved Conditions) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Maximum Pool Elevation (feet) | Area Flooded at Maximum Pool (acres) | Duration of Pool Flooding (days) | Maximum Pool Elevation (feet) | Area Flooded at Maximum Pool (acres) | Duration of Pool Flooding (days) | Maximum Pool Elevation (feet) | Area Flooded at Maximum Pool (acres) | Duration of Pool Flooding (days) |
| 2-Year | 911.7 | 240 | 2.5 | 920.9 | 740 | 5.3 | +9.2 | +500 | +2.8 |
| 10-Year | 914.1 | 320 | N/A | 922.5 | 850 | N/A | +8.4 | +530 | N/A |
| 20-Year | 914.9 | 390 | N/A | 922.5 | 850 | N/A | +7.6 | +460 | N/A |
| 50-Year | 915.8 | 430 | 4.2 | 922.5 | 850 | 7.4 | +6.7 | +420 | +3.2 |
| 100-Year | 916.4 | 470 | N/A | 922.5 | 850 | N/A | +6.1 | +380 | N/A |
| 200-Year | 917.1 | 500 | 4.1 | 922.5 | 850 | 8.1 | +5.4 | +350 | +4.0 |
| 500-Year | 917.6 | 520 | N/A | 922.5 | 850 | N/A | +4.9 | +330 | N/A |
| SPF | 923.8 | 930 | N/A | 924.5 | 980 | N/A | +0.7 | + 50 | N/A |

N/A = Data Not Available.

Table 4.4 - Tonawanda Creek, New York - Changes in Flooding Conditions with the Project

| Flood Frequency | Depth of Flood (feet) | Area Flooded (acres) | Duration (days) |
|---|---|---|---|
| Lower Reservoir | | | |
| 2-Year | +6.2 | + 610 | +7.4 |
| 10-Year | +1.2 | - 630 | +2.1 |
| 20-Year | +1.3 | - 620 | +3.5 |
| 50-Year | +1.9 | - 500 | +3.8 |
| 100-Year | +1.5 | - 330 | +3.4 |
| 200-Year | +3.0 | - 170 | +2.5 |
| 500-Year | +3.3 | - 60 | +2.2 |
| SPF | +0.5 | -2,100 | +0.0 |
| Upper Reservoir | | | |
| 2-Year | +9.2 | + 500 | +2.8 |
| 10-Year | +8.4 | + 530 | N/A |
| 20-Year | +7.6 | + 460 | N/A |
| 50-Year | +6.7 | + 420 | +3.2 |
| 100-Year | +6.1 | + 380 | N/A |
| 200-Year | +5.4 | + 350 | +4.0 |
| 500-Year | +4.9 | + 330 | N/A |
| SPF | +0.7 | + 50 | N/A |

N/A = Data Not Available.

4.14 Table 4.3 presents similar data for operation of the upper reservoir. Although the differences are not as pronounced as for the lower reservoir, it is still apparent that the 2-year controlled flood actually creates the greatest changes from naturally occurring flooding within the reservoir floodpool. Table 4.4 summarizes the information on changed flood conditions for operation of both the upper and lower reservoirs.

4.15 As the frequency, depth, and duration of flooding are some of the most important factors in determining the effects of intermittent flooding on vegetation and the fact that operating the reservoirs to control the 2-year flood creates the greatest changes from naturally occurring flooding within the floodpools, operating to control the 2-year flood has been selected as the basis of this analysis. This does not imply that operating the reservoirs to control less frequent floods has lesser overall impact. In most cases, flooding is more severe and has a longer duration than for the 2-year flood. However, the changes from naturally occurring flooding is less and the frequency of such floods is much less; therefore, recovery can be assumed.

4.16 Impacts of Operation - Table 4.5 indicates the additional area that will be flooded, by habitat types, with operation of the Batavia Reservoir Compound (Modified) to control the 2-year frequency of flood. For the lower reservoir, this area is 610 acres in size and comprises all areas between 891.8 and 898.0 feet in elevation. For the upper reservoir, this area is 500 acres in extent and comprises all areas between 911.7 and 920.0 feet in elevation. This data on elevation was superimposed upon the map of habitat types supplied by the U. S. Fish and Wildlife Service in the Coordination Act Report. From this, the areas of additional flooding with operation of the Batavia Reservoir Compound (Modified) to control the 2-year flood were computed.

4.17 As indicated in Table 4.5, the majority of additionally flooded area is composed of pasture and cropland. For the upper reservoir, this pasture and cropland is 299 of 500 acres (59.8 percent) and for the lower reservoir, it is 324 of 611 acres (53.0 percent).

4.18 Effects of Sedimentation and Siltation - One of the major potential effects of the impoundment of water in reservoirs is the possible settling out of suspended sediments. Such sediments, if deposited in heavy quantities, can have major adverse effects on vegetation present in the area. Table 4.6 presents data on potential settling times for various diameter sediments in the lower reservoir. The reservoir was assumed to be full and the mean depth was assumed to be the volume divided by the surface area.

Mean Depth Lower Reservoir (when full) = volume/area
= 15,500 ac-ft/2,560 acres
= 6.05 feet

Under natural conditions during the 2-year flood, the lower reservoir area will have water overbank for 2.4 days during which time (assuming quiescent conditions) suspended fine sand and larger diameter particles will settle. With the reservoir in operation, water will be impounded for 9.8 days during which time it is expected that suspended particulate matter with a diameter approximately greater than 0.005 cm (coarse silt) will settle.

4.19 No data currently exists on suspended sediment for Tonawanda Creek. However, visual observations of bank material along Tonawanda Creek indicate that most of the bank material, therefore material that would be suspended in the waters of Tonawanda Creek, are fine silts (roughly with diameters of 0.001 cm to 0.005 cm). As indicated in Table 4.6, these types of silt would take between 10.7 and 267 days to settle 6 feet in the lower reservoir floodpool.

4.20 As indicated in Table 4.3, the duration of pool flooding for the 2-year flood for the upper reservoir is 5.3 days, and for the lower reservoir (Table 4.2) is 9.8 days. These are relatively short time periods when considering settling of fine silts. Therefore, for the purpose of this analysis, it is predicted that there will be minor insignificant settling of suspended sediments from operation of the reservoirs and that any impacts on fish and wildlife habitat within the reservoir floodpools from sedimentation will be insignificant.

Table 4.5 - Tonawanda Creek, NY - Additional Areas Flooded, By Habitat Types, from Operation of the Batavia Reservoir Compound (Modified) to Control the Two-Year Frequency Flood 1/

| Habitat Type | Upper Reservoir (acres) | Lower Reservoir (acres) | Total (acres) |
|---|---|---|---|
| Cropland | 202 | 275 | 477 |
| Pasture | 77 | 49 | 126 |
| Shrub Swamp | 63 | 72 | 135 |
| Forested Wetland | 83 | 198 | 281 |
| Emergent Marsh | 75 | 17 | 92 |
| Totals | 500 | 611 | 1,111 |

1/ The acreage in this table only represents additional areas within the reservoir floodpools that will be inundated to control the 2-year flood. Areas less than 891.8 feet (lower reservoir) and 911.7 feet (upper reservoir) in elevation will be flooded whether or not the reservoirs are in place and operating to control the 2-year flood. However, the depth and duration of flooding will be increased in such areas.

Table 4.6

| Diameter (CM) | Classification | Fall Velocity $V_s$ cm/sec (2) | Time to Settle 6 Feet Days |
|---|---|---|---|
| .001 | Silt | $8 \times 10^{-6}$ | 267 |
| .002 | Silt | $3.2 \times 10^{-5}$ | 66.7 |
| .005 | Silt | $2 \times 10^{-4}$ | 10.7 |
| .01 | Fine Sand | $8 \times 10^{-4}$ | 2.7 |
| .02 | Fine Sand | 2.4 | 1.28 minutes |

(2) The fall velocity was determined using Stokes' Law, the drag coefficient for spheres at $V_s$ and a value of 2.65 for particle specific gravity.

TOTAL IMPACTED AREA

4.21 Summary - Table 4.7 presents a compilation of the total area, by wildlife habitat type, that will be impacted by construction of the Batavia Reservoir Compound (Modified) and operating it to control the 2-year frequency flood.

DEGREE OF IMPACT

4.22 Construction Areas - In areas where construction of the dams and training dikes occurs, the habitats present will be totally destroyed, being replaced with structures designed to control flood waters. These acreage and habitat types of areas are listed in Table 4.1.

4.23 Clearing and Snagging Areas - As discussed in paragraph 4.03, about 158 acres of forested wetland will be effected by clearing and snagging of the Tonawanda Creek channel within the project limits. It is difficult to predict what will actually happen to the forested wetland habitat along the creek channels with removal of all dead and dying trees. However, this will, no doubt, seriously impact on the habitat present and its usefulness as breeding and feeding areas for the various wildlife species that presently inhabit the area.

4.24 Areas Effected by Operation of the Reservoirs - As discussed previously, numerous factors have a part in determining the effects of intermittent flooding on vegetation. One of the most important of these factors is the time of year when flooding occurs. Therefore, for this analysis, all instances of flows over 2,000 cfs at the Batavia gauging station for the period 1945 to 1979 were compiled on a monthly basis to determine when flooding most frequently occurs on Tonawanda Creek. From 1945 to 1979 flows of 2,000 cfs or greater were recorded at the Batavia gauging station on 99

Table 4.7 - Tonawanda Creek, New York - Total Impacted Area, By Habitat Types from Construction of the Batavia Reservoir Compound (Modified) and Operation to Control the Two-Year Flood (In Acres).

| Habitat Type | Construction | Clearing and Snagging | Operation Upper Res. | Operation Lower Res. | Total |
|---|---|---|---|---|---|
| Cropland | 66 | - | 202 | 275 | 543 |
| Pasture | 5 | - | 77 | 49 | 131 |
| Shrub Swamp | 28 | - | 63 | 72 | 163 |
| Forested Wetland | 9 | 158 | 83 | 198 | 448 |
| Emergent Marsh | 8 | - | 75 | 17 | 100 |
| Totals | 116 | 158 | 500 | 611 | 1,385 |

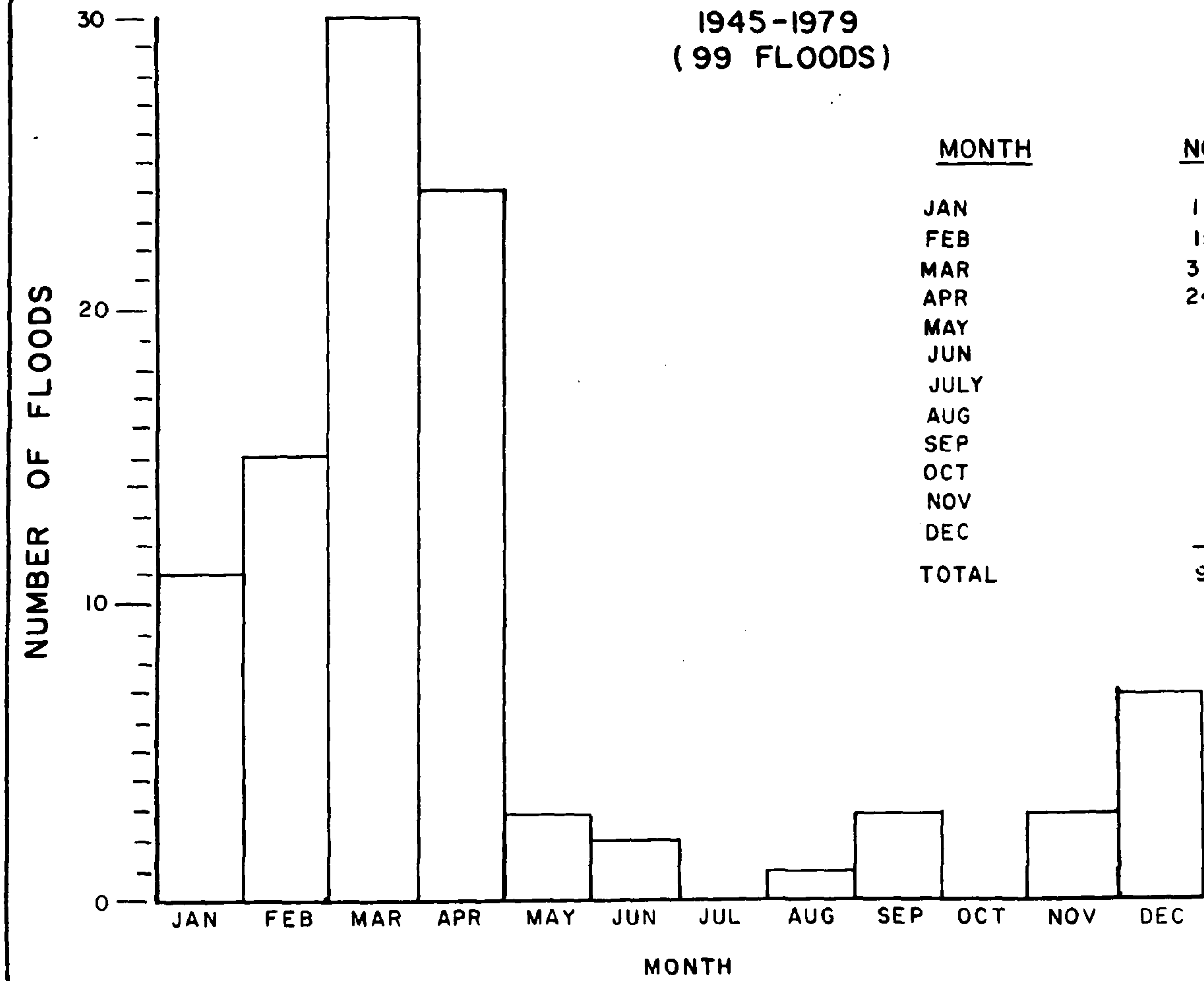
different occasions. As illustrated on Plate 4.1, the vast majority of these floods (80 or 80.8 percent) occur during the months of January to April. Late spring and summer floods occur infrequently. For the months of June through September, only six flows (6.1 percent) of the 2,000 cfs or greater have been recorded at the Batavia gauging station during the period of record, 1945 to 1979. Probably, the most important factor in determining the impact on plants, particularly woody plants, is whether or not they are inundated during the growing season. Woody vegetation is affected much less severely by flooding during the dormant season than during the growing season. The growing season for most woody vegetation in the area of Batavia Reservoir Compound commences in late April or early May. Therefore, the flow data for the Batavia gauging station for the period of record 1945 to 1979 was compiled on a weekly basis for the months of April and May. This data is presented on Plate 4.2. A total of 27 flows greater than 2,000 cfs have occurred during April and May from 1945 to 1979. Of this total, 20 floods (74.1 percent) occurred during the first 3 weeks of April and the remaining seven occurred during the latter part of April and May.

4.25 During the growing season for woody vegetation within the compound area (roughly the end of April through October), 10 of 99 floods (10 percent) of 2,000 cfs or greater have occurred. Related to the potential effects of flooding on vegetation, it is apparent that there is a reasonable chance that flooding could occur during the growing season causing the maximum possible effect on vegetation in the areas affected.

4.26 Basis of Analysis. Due to the fact that flooding could occur during the growing season numerous times during the life of the project, it is quite possible that all the habitat acreages presented in Table 4.5 could be affected enough to preclude the survival of most woody vegetation in the flooded areas. The only exceptions are for cropland and pasture. Although such areas will be flooded, they will still be available for farming and/or use as pasture. It is highly unlikely that these areas will be abandoned as the new channel capacity in Tonawanda Creek, obtained by clearing and snagging, will in most years enhance farming opportunities within the reservoir floodpools. Therefore, for this analysis, the predicted effect on farmlands and pasture is zero acres affected. Under the 2-year flood operation, the predicted total adverse effect on shrub swamp, forested wetland, and emergent marsh is that presented in Table 4.5.

4.27 Summary - The total net effect on habitat types present in the project area from construction and operation (2-year flood operation) is presented in Table 4.8. These figures will be used in Section 5 of this appendix to determine the amount of fish and wildlife mitigation that is recommended for the Batavia Reservoir Compound (Modified).

## TONAWANDA CREEK
### JAN/DEC
### NUMBER OF FLOWS
### 2,000 cfs or greater
### 1945-1979
### (99 FLOODS)




| MONTH | NO. | Pct |
|---|---|---|
| JAN | 11 | 11.1 |
| FEB | 15 | 15.2 |
| MAR | 30 | 30.3 |
| APR | 24 | 24.4 |
| MAY | 3 | 3.0 |
| JUN | 2 | 2.0 |
| JULY | 0 | 0.0 |
| AUG | 1 | 1.0 |
| SEP | 3 | 3.0 |
| OCT | 0 | 0.0 |
| NOV | 3 | 3.0 |
| DEC | 7 | 7.1 |
| TOTAL | 99 | 99.9 |

PLATE 4.1

# TONAWANDA CREEK
## APRIL / MAY

NUMBER OF FLOWS
2,000 cfs or greater

1945-1979
(27 FLOODS)

| PERIOD | NO. | Pct |
|---|---|---|
| APR 1-7 (1945–1979) | 15 | 55.6 |
| APR 8-14 (1945–1979) | 3 | 11.1 |
| APR 15-21 (1945–1979) | 2 | 7.4 |
| APR 22-28 (1945–1979) | 3 | 11.1 |
| APR 29–MAY 5 (1945–1979) | 2 | 7.4 |
| MAY 6-12 (1945-1979) | 1 | 3.7 |
| MAY 13-19 (1945-1979) | 0 | 0.0 |
| MAY 20-26 (1945-1979) | 1 | 3.7 |
| MAY 27-30 (1945-1979) | 0 | 0.0 |
| Total | 27 | 100.0 |

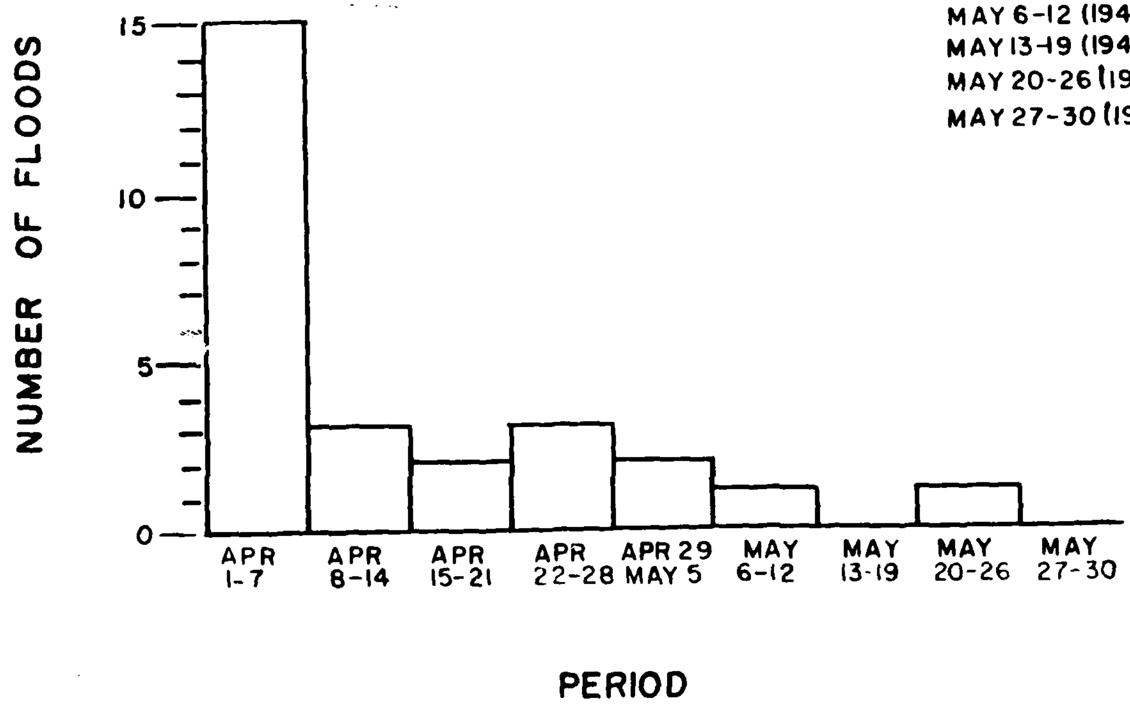


Table 4.8 - Tonawanda Creek, New York - Total Net Effect By Habitat Types for Construction and Operation (Two-Year Flood, Worst-Case) of the Batavia Reservoir Compound (Modified) Plan (In Acres)

| Habitat Type | Construction | Clearing and Snagging | Operation Upper Res. | Operation Lower Res. | Total |
|---|---|---|---|---|---|
| Cropland | 66 | - | - | - | 66 |
| Pasture | 5 | - | - | - | 5 |
| Shrub Swamp | 28 | - | 63 | 72 | 163 |
| Forested Wetland | 9 | 158 | 83 | 198 | 448 |
| Emergent Marsh | 8 | - | 75 | 17 | 100 |
| Total | 116 | 158 | 221 | 287 | 782 |

## 5. CONCLUSIONS ON MITIGATION

5.01 Introduction - The previous section presented an analysis of the total net-impact of construction and operation of the Batavia Reservoir Modified Plan. The total areas impacted, by habitat types, are summarized in Table 4.8. This section provides conclusions on the amount of impacted areas, by habitat type for which the Buffalo District recommends mitigation.

5.02 Cropland, Pasture - As previously discussed, 66 acres of cropland and 5 acres of pasture will be destroyed by construction of the project. It is general Corps of Engineers Policy (see discussion in Section 2) that mitigation only be considered for habitats that are scarce or otherwise significant. Cropland and pasture are very common in the project area and in surrounding areas and are not particularly significant wildlife habitats. Therefore, it is concluded that mitigation is not warranted for the 66 acres of cropland and 5 acres of pasture.

5.03 Shrub Swamp, Forested Wetland, Emergent Marsh - Table 4.8 indicates that 448 acres of forested wetland, 163 acres of shrub swamp, and 100 acres of emergent marsh could be impacted by construction and operation of the Batavia Reservoir Compound (Modified). These wetland areas are significant for several reasons. First of all, being wetlands, they are defined as significant by Federal and State laws and Executive Orders relative to wetland protection. Forested wetland, particularly that which occurs along the banks of Tonawanda Creek, is valuable for the creek's fishery as it provides a heavy shade cover along most of the creek. The creek itself, although highly turbid, is rated as a Class A stream. Class A is the highest classification given to streams in New York State. Forested wetlands within the project area also provide very good nesting habitats for numerous species of birds.

5.04 Emergent marshes within the project area have standing water throughout the year with extensive cattail stands. These areas are valuable to wildlife and are used extensively by migrating waterfowl during the spring and summer. Shrub swamps are dominated by woody species, including dogwoods, cottonwoods, and ashes. Wildlife use of these areas is extensive and many shrub species provide an important food source for migrant and resident wildlife. Additional information on these wetland habitats is contained in the U.S. Fish and Wildlife Coordination Act Report, Appendix G.

5.05 Comparison of Fish and Wildlife Service and Corps Mitigation Conclusions - The U.S. Fish and Wildlife Service, as a result of the HEP analysis, recommended that the Tonawanda Creek project be authorized with compensation lands comprised of 475 acres of forested wetland, 153 acres of shrub swamp, and 37 acres of emergent marsh for a total of 665 acres. The analysis presented in this report concluded that 711 acres of mitigation would be required (forested wetland, 448 acres; shrub swamp, 163 acres; and 100 acres of emergent marsh). The Fish and Wildlife analysis assumed that large areas within the upper and lower floodpools would be converted to unstable mudflats with no wildlife habitat value. The Buffalo District analysis concluded that any such sedimentation effect would be minor and have insignificant effect on wildlife habitats present within the reservoir

floodpools. The Buffalo District analysis compared existing habitat flooding to the areas that would be flooded with operation of the project. It is extremely difficult, if not impossible, to determine what the absolute impact of intermittent flooding will have on these habitat areas. Numerous interacting factors including, but not limited to, the time of year flooding occurs, depth of flooding, duration of flooding, tolerance of vegetative species to flooding, and timing of floods all have a part in determining effect. The total effect on additionally flooded habitats could range from 0 percent (no effect) to 100 percent (complete destruction of habitat). Most likely, the actual impact will be somewhere between, but this is impossible to determine. The Buffalo District believes that the analysis presented in this report is a more reliable prediction of impacted areas than the HEP analysis, which has several major assumptions. Therefore, the mitigation conclusion for the Tonawanda Creek Study is based upon this analysis.

5.06 Conclusion - The Buffalo District feels, based upon the previous analysis that mitigation is warranted for all wetland areas that will and could be affected by construction and operation of the proposed project. It is possible that all additional areas flooded with operation may not be severly affected. However, there is a reasonable chance that flooding may occur on a frequent basis severly impacting wetland habitats present within the boundaries of the floodpools. The total amount of area recommended for mitigation is 711 acres composed of 448 acres of forested wetland, 163 acres of shrub swamp, and 100 acres of emergent marsh. This would be in-kind mitigation in the immediate vicinity, but outside the boundaries of the Batavia Reservoir Compound (Modified) floodpools. Possible mitigation/compensation areas have been identified in a 29 December 1980 letter from the New York State Department of Environmental Conservation (attached to the U. S. Fish and Wildlife Service Coordination Act Report, Appendix G).

5.07 Economic Justification - For the purposes of the Tonawanda Creek Final Feasibility Report, this analysis has concluded that 711 acres of habitat should be obtained for mitigation/compensation. The first costs of obtaining easements on lands for fish and wildlife compensation purposes is $296,000 (June 1980 prices). This cost does not significantly alter the benefit/cost ratio of the project which has a total first cost of $22,680,000.

5.08 Phase I GDM - It is possible that after authorization of the project that AE&D studies may alter the construction design and/or operational plan for the reservoirs. If so, then the mitigation conclusions reached in this analysis and the recommendations for fish and wildlife compensation lands can be adjusted.

APPENDIX B

LETTERS OF COORDINATION

TROUT UNLIMITED

340 Capen Boulevard
Amherst, New York 14226
November 16, 1979

Mr. Joseph Hassey, Project Manager
U. S. Army Corps of Engineers
1776 Niagara Street
Buffalo, New York

Re: The Damming of Tonawanda Creek in the
area of Batavia, N. Y. and Rte. 20

Dear Sir:

We, the members of the Western New York Chapter of Trout Unlimited, are concerned with the damming of Tonawanda Creek between Batavia, New York and Route 20 since this stretch of water contains game fish such as Brown Trout and Smallmouth Black Bass.

We are concerned that provisions be made in the design of the dam so that an adequate flow of water be maintained from the dam at all times. Also, we are concerned that the design of the outflow from the dam be such that the water temperature be controlled to maintain the present stream ecology. Provisions should be made to prevent excess of siltation occurring down-stream from the dam.

We strongly urge that these suggested measures be incorporated in the design of this project. We will be glad to suggest further details of design from our library of stream ecology if you do not have such details.

Thank you for your consideration of our suggestions.

Very truly yours,

Gordon Deitrick

Gordon Deitrick, Pres.
WNY Chapter Trout Unlimited

United States Department of the Interior

NATIONAL PARK SERVICE

*NORTH ATLANTIC REGION*
150 CAUSEWAY STREET
BOSTON, MA. 02114

IN REPLY REFER TO:
L-7619-NAR-(CE)
NCBED-PN

January 5, 1976

Colonel Byron G. Walker
Deputy District Engineer
Department of the Army
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Dear Colonel Walker:

This responds to your letter of 15 December requesting our comments on the Preliminary Feasibility Report on Flood Management in the Tonawanda Creek Watershed, New York.

We are pleased to note the report's coverage of cultural resources (pp. 32 and 33) and the commitment to accomplish cultural resource literary studies. Further, we understand that the information found in these literary searches will be used in the identification and development of mitigating measures as necessary to protect cultural resources that may be affected by specific project works of the overall flood management plan.

We also note the report's mention of the Erie (later) Barge Canal in the study area. The further literary searches should help to focus on the recognized resources and probable archeological values related to that historic waterway. While we, at this time, see but one National Historic Landmark in the study area, there are doubtless a number of sites listed or in the process of being considered for inclusion on the National Register of Historic Places that could be affected by project work. Therefore, we would suggest that in addition to checking the National Register of Historic Places, contact should be maintained with the State Historic Preservation Officer (Mr. Orin Lehman, Commissioner, Parks and Recreation, Room 303, South Swan Street Building, Albany, New York 12223) to assure no oversight.

Literary research performed by competent archeologists should provide the necessary basis to determine the location and scope of field surveys and need for excavations to assure the utmost protection for any significant

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

archeological values that could be destroyed by project works. We would suggest contact with the New York Archeological Council (Dr. Thomas King, 4242 Ridge Lea Road, Buffalo, New York 14226) and/or the State Archeologist (Dr. Robert E. Funk, New York State Museum and Science Service, Albany, New York 12224) for assistance in pursuing the archeological sectors of the literary searches to be performed.

In addition to the above, concerning the protection of significant natural resources, we suggest that the literary search and other continuing investigations include a check of existing and potential National Natural Landmark designations. Assistance for identifying Natural Landmarks can be requested from this office or from our Natural Landmarks Specialist (Mr. Paul Favour, P. O. Box 187, Northeast Harbor, Maine 04662).

We will be most anxious to see and review the final feasibility study inclusive of natural and cultural resource protection considerations, and we appreciate this early opportunity to comment on this preliminary report.

Sincerely yours,

Jerry D. Wagers
Regional Director

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
100 Grange Place, Room 202
Cortland, New York 13045

January 28, 1976

District Engineer
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Dear Sir:

This responds to LTC Byron Walker's December 15, 1975 letter requesting our comments on your Preliminary Feasibility Report on Flood Management in the Tonawanda Creek Watershed, New York.

The following comments are provided as a result of informal field review. They are submitted by the U. S. Fish and Wildlife Service as technical assistance for input to your final plan for Flood Management in the Tonawanda Creek Watershed. Further review will be undertaken by this Service during the Departmental review process when the Departmental position will be provided.

The U. S. Fish and Wildlife Service has provided prior reports to the District Engineer, Buffalo District, on several of the flood management measures being considered in the Preliminary Feasibility Report. In our February 2,1960 report, we discussed the possible effects on fish and wildlife resources of modifications to the existing Corps project at Batavia and of a storage reservoir or reservoirs on the headwaters of Tonawanda Creek. On February 8, 1961, we issued a preliminary report on fish and wildlife resources of the Tonawanda Creek basin and then issued a supplemental to the preliminary report on October 2, 1967.

We have reviewed your Preliminary Feasibility Report and find that four regional measures and one local protection measure are presently being considered for Flood Management in the

Tonawanda Creek Watershed. The four regional measures consist of Sierks Reservoir, Linden Reservoir, Alabama Pools, and the Batavia Reservoir Compound. The local protection measure involves the modification of the existing Corps project at Batavia, New York These flood management measures have also been considered in combination to form several plans for basin flood management.

We offer the following specific comments on the considered flood management measures:

Batavia Reservoir Compound. This measure involves two shallow detention reservoirs arranged in series designed to intercept all runoff from that part of the Tonawanda Creek Watershed upstream from the city of Batavia, New York. Since these reservoirs will normally be dry, no significant fisheries impact can be expected except during the construction phase when some disturbance of the existing warmwater fishery, consisting of such species as smallmouth bass and northern pike, will occur.

Wildlife resources consist of a variety of species. There are white-tailed deer in the basin and upland game populations of pheasants and ruffed grouse. Muskrats, beavers, racoons, and red foxes as well as an occasional siting of otters are some of the furbearing mammals in the area. Waterfowl hunting occurs along Tonawanda Creek, its tributaries, and associated wetlands. The magnitude of this type of hunting in the proposed project area has not been determined. However, since the proposed reservoirs will normally be dry, no significant impact on wildife resources is currently expected.

One consideration that must be addressed, is the effect the Batavia Reservoir Compound will have on the present cooperative hunting area leased from local land owners by the New York State Department of Environmental Conservation (NYSDEC).

Modification to the Existing Batavia Project. This local protection measure involves levees, bank protection, and channel enlargement within the city of Batavia and downstream to Bushville, New York. The NYSDEC has no current fisheries data on this portion of the Tonawanda Creek. Expected warm-water species include smallmouth bass, northern pike, and some panfish and bullheads below Batavia. The channel modification's impacts on these fishery resources cannot be accurately determined at present due to the lack of current fishery data.

The Batavia to Bushville section of the Tonawanda Creek is primarily agricultural. Wildlife species that will be affected by the resultant disturbance of stream-bank vegetation from levees, bank protection, and channel enlargement consist of songbirds, some pheasant wintering area, and various furbearers including muskrats and possible otters.

Alabama Pools. This measure is a complex of reservoirs including both storage and detention reservoirs in the vicinity of the NYSDEC Tonawanda Wildlife Management Area (WMA). The Alabama Pools would have no beneficial effect on fisheries resources of the area, however, this alternative would have serious adverse consequences on wildlife resources associated with the state's existing Tonawanda WMA.

Coordination with the NYSDEC has indicated that the Tonawanda WMA habitat conditions are nearly ideal for the production, enhancement, and enjoyment of the waterfowl resource and other marsh-related wildlife species. The NYSDEC has presently spent upwards of $25,000 on establishing the ideal wetland habitat conditions which according to present data supports waterfowl hunting providing approximately 2500 man-days of recreation annually with an annual harvest of approximately 1500 ducks and geese. The Alabama Pools project would result in the destruction of much of the NYSDEC developmental work in the area. Recent expenditures by the NYSDEC have been made in order to prevent damaging flood waters from entering the Tonawanda WMA impoundments, just the opposite of the Alabama Pools proposal.

The present system of shallow marshlands created by the low dikes of the Tonawanda WMA supports aquatic submerged, emergent, and floating vegetation, together with small pockets of open water. These important wetland habitat conditions attract waterfowl for cover, resting, food, and nesting during the spring, summer, and fall. The storage of spring flood waters at the depths proposed in the Alabama Pools will result in disastrous effects on both aquatic and terrestrial vegetation. Desired growth of aquatic plants that do poorly in deep water, even for short periods of time,will be severely retarded or destroyed. Proposed spring flood water depths will also have serious adverse effects on nesting waterfowl and shorebirds as well as the valuable furbear resource present on the area.

The Alabama pools may also have severe adverse impacts on several rare and endangered bird species sighted around the Iroquois National Wildlife Refuge and Tonawanda Wildlife Management Area. These sightings include golden eagles (rare), bald eagles and the American Perigrine Falcon (endangered) and ospreys (undetermined). Additional studies on this matter are necessary.

Sierks Reservoir. This protection measure is a storage reservoir on Tonawanda Creek in the Cattaraugus Hills, near the hamlet of Sierks, New York. It is proposed as a multi-purpose project for flood management, fishery enhancement, recreation, water quality management and irrigation.

As discussed in our October 2, 1967 Fish and Wildlife Service Supplemental Report, fish and wildlife resources within the area of project influence involve a limited warm water fishery. This fishery is expected to consist of smallmouth bass, northern pike, rock bass, pumpkinseed, and bullhead.

Due to the limited warmwater fishery, Sierks Reservoir may afford substantial opportunitites for the development of this type of fishery as well as a possible trout fishery. However, the project area's wildlife resource will be lost through inundation. The project area supports a moderate wildlife population comprised of such species as cottontail rabbit, ruffed grouse, raccoon, and fox. Lack of suitable habitat is responsible for low populations of pheasants, muskrats, and waterfowl. The project area does, however, support a wintering area for white-tailed deer.

The multi-purpose benefits for this measure can only be determined after further detailed studies. The potential recreation and fishery benefits must be weighed against the loss of wildlife resources.

Linden Reservoir. This measure is a storage reservoir on Little Tonawanda Creek in the Cattaraugus Hills, near the hamlet of Linden, New York. It is proposed as a multi-purpose project for flood management, fishery enhancement, recreation, water quality management and irrigation.

This reservoir would probably permit the development of a warm-water fishery superior to the existing stream fishery. Little Tonawanda Creek within the project area is fairly sluggish with erodible, silty banks, and little cover. Although the stream is less than ideal, it is being stocked with brown trout by the NYSDEC in a 3.2 mile stretch extending upstream from just above Linden to Dale, New York. Fishery resources within the project area also include panfish (primarily rockbass), suckers, and common shiners and associated minnows.

The proposed project area supports a moderate population of wildlife including white-tailed deer, cottontail rabbit, ruffed grouse, raccoon, and fox. As found at the proposed Sierks Reservoir area,lack of suitable habitat is responsible for low populations of pheasant, waterfowl and muskrat.

The construction of Linden Reservoir will result in the loss of wildlife resources as well as the present NYSDEC brown trout stream stocking program. These losses must be considered when discussing the potential benefits of recreation and an improved warmwater fishery. The multi-purpose benefits for this measure can only be determined after further detailed studies.

Of the four regional and one local protection measures presented in your Preliminary Feasibility Report, the Batavia Reservoir Compound will have the least impact on fish and wildlife resources. This measure will also benefit the NYSDEC Tonawanda Wildlife Management Area by preventing inundation from floodwaters. The Alabama Pools measure will have the most disastrous impact on fish and wildlife resources. This measure will destroy the already present ideal habitat conditions for production, enhancement, and enjoyment of the waterfowl resource and other marsh-related wildlife species.

We appreciate the opportunity to comment on your Preliminary Feasibility Report at this time and look forward to further coordination on the Tonawanda Creek Watershed Flood Management project.

Sincerely yours,

Willard W. Cole, Jr.
Area Office Supervisor

NEW YORK STATE
**DEPARTMENT OF TRANSPORTATION**
Raymond T. Schuler, Commissioner

1220 Washington Avenue, State Campus, Albany, New York 12226

December 8, 1975

LTC Byron G. Walker
Corps of Engineers
Deputy District Engineer
Department of the Army
1776 Niagara Street
Buffalo, New York 14207

Dear LTC Walker:

Your letter of December 1 has been received and forwarded to Mr. K. W. Shiatte, Director of our Development Division, for reply. Any future correspondence should be directed to Mr. Shiatte at the following address:

Mr. K. W. Shiatte, Director
Development Division
New York State Department of Transportation
1220 Washington Avenue
State Campus
Albany, New York 12232

Please send a carbon copy of the notification letter, without attachments, to Mr. J. K. Mladinov, Assistant Commissioner for Planning and Development, at the above address. Thank you.

Sincerely yours,

Wilson Campbell

E. Wilson Campbell
Director, Planning Division

EWC:BHC

**New York State Department of Environmental Conservation**
Region 9 Fish & Wildlife Office
128 South Street
Olean, New York 14760

Ogden Reid,
Commissioner

December 18, 1975

Mr. Bernard C. Hughes
Colonel, Corps of Engineers
Buffalo District
1776 Niagara Street
Buffalo, New York 14207

Dear Colonel Hughes,

I did not have an opportunity to attend the public meeting November 20, 1975 concerning flood management along the Tonawanda Creek.

I would like to bring your attention to a matter of interest to the Region 9 Wildlife Unit concerning the study area.

Region 9 Wildlife personnel have identified a major deer wintering area in the Tonawanda Creek valley between the Sierks reservoir dam site and Varysburg in Wyoming County. It is entirely possible that a reservoir in this area would significantly affect this wintering area and consequently the deer herd in a much larger area. I have encircled in red on a map of the study area the approximate location of the area of concern. A detailed analysis of the effects of a reservoir in this area will require considerable time.

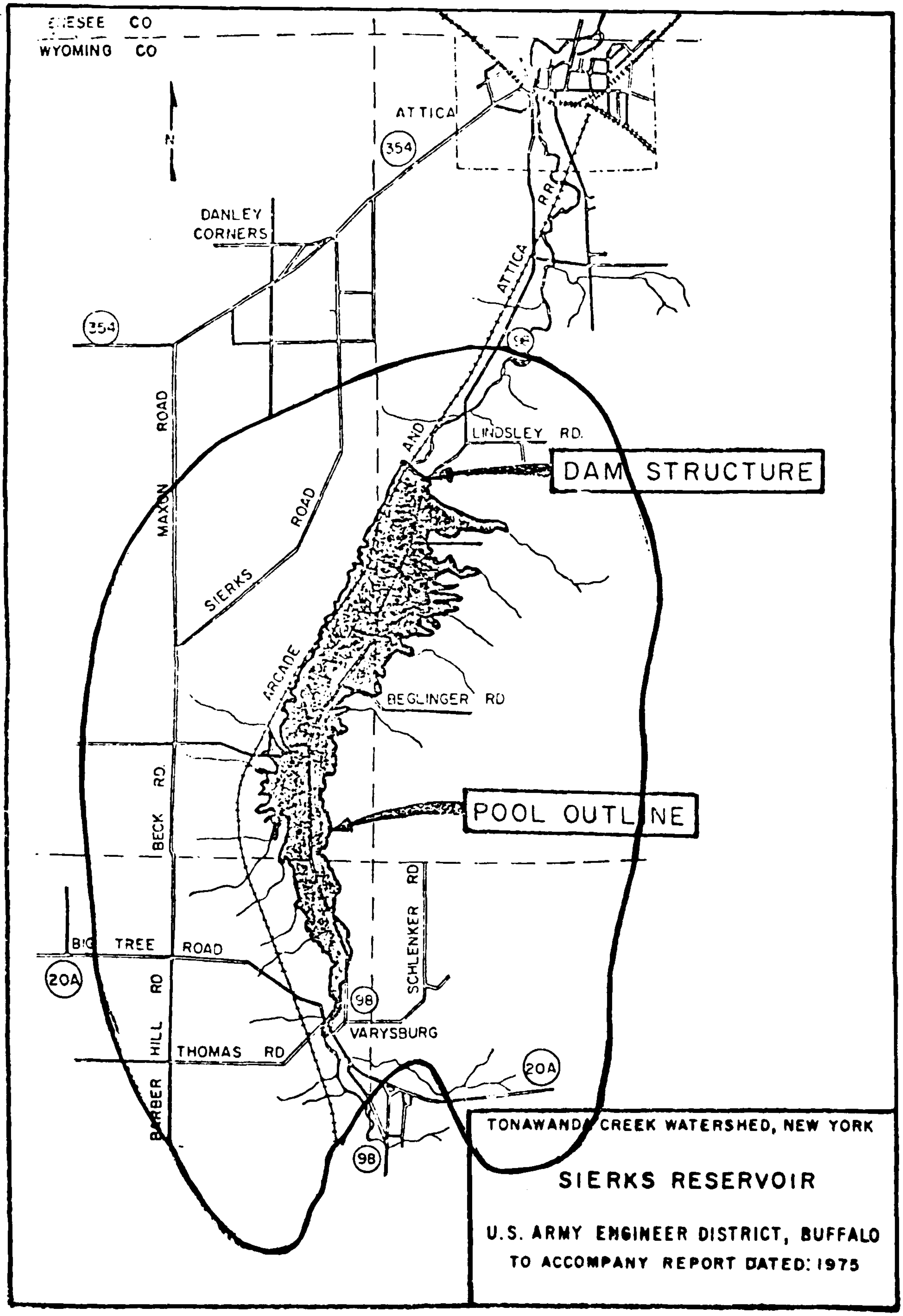
Thank you for the opportunity to comment on this proposal.

Very truly yours,

R L Cheney

Russell L. Cheney
Regional Wildlife Manager
Region 9

RLC/dm
Encl.
cc: L.S. Nelson
J. Dell


WYOMING CO
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SIERKS ROAD
ATTICA AND ARCADE RR
LINDSLEY RD.
DAM STRUCTURE
BEGLINGER RD
POOL OUTLINE
BECK RD.
SCHLENKER RD
BIG TREE ROAD
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VARYSBURG
BARBER HILL RD
THOMAS RD
20A
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TONAWANDA CREEK WATERSHED, NEW YORK
SIERKS RESERVOIR
U.S. ARMY ENGINEER DISTRICT, BUFFALO
TO ACCOMPANY REPORT DATED: 1975

**New York State Department of Environmental Conservation**
50 Wolf Road, Albany, New York 12233

Ogden Reid,
Commissioner

January 7, 1976

Colonel Bernard C. Hughes
District Engineer
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Dear Colonel Hughes:

We have reviewed your report entitled Considered Structural Alternatives for Flood Control in the Tonawanda Creek, New York and have the following comments:

1. Alternative #1 - Sierks Reservoir

   Although this alternative would be consistent with the State-adopted Erie-Niagara Basin Plan, there are several significant environmental concerns which must be considered. A major deer wintering area in the Tonawanda Creek Valley between the Sierks reservoir dam site and Varysburg has been identified. It appears that a reservoir in this area would significantly affect this wintering area and consequently, the deer herd in a much larger area. In addition, the impacts associated with relocating Route 98, which is presently within the proposed reservoir pool, will have to be carefully evaluated. The impact of the project on wetlands and active agricultural activities must also be considered.

2. Alternative #2 - Linden Reservoir

   This measure is also consistent with the State-adopted Erie-Niagara Basin Plan. Although no specific adverse impacts have been identied, the impact of the project on wetlands and active agricultural activities will have to be carefully reviewed as additional information becomes available.

3. Alternative #3 - Alabama Pools

   One of our major concerns is the potential loss of wetlands resulting from various alternatives of the watershed project. The Alabama Pools alternative appears to have the greatest potential for adverse impacts on wetlands. It may have an adverse impact on the Tonawanda Wildlife Management Area, which has been developed approximately 80% by this Department, and would negate some of the previously completed development. In addition, this measure may affect portions of two agricultural districts comprising approximately 43,000 acres in the Towns of Batavia, Alabama, Oakfield and Pembroke.

4. Alternative #4 - Batavia Reservoir Compound

From an environmental viewpoint, this measure would probably have the least amount of adverse impacts when compared to the other alternatives. A major concern in conjunction with this measure would be the loss of productive farmland. However, since both detention reservoirs would normally be dry, provisions could be made to permit existing farming operations to continue as long as such activities do not affect the integrity of the flood protection provided. In addition, the limited period of flood water inundation associated with these types of structures (dry dams) would probably have a minimal impact on wetlands and wildlife habitat within the project area.

5. Alternative #5 - Modification to Existing Corps Project at Batavia

This measure may have a significant impact on Tonawanda Creek in the Batavia area, which could conflict with fishery management plans. The potential for adverse impacts would result primarily from the recommended enlargement of the stream channel for approximately 2½ miles.

Thank you for the opportunity to review the proposed project alternatives. We, of course, would like to receive additional information as it becomes available.

Very truly yours,

Terence P. Curran
Director of Environmental Analysis

TOWN OF BATAVIA
TOWN HALL
4165 WEST MAIN STREET ROAD
BATAVIA, NEW YORK 14020

FOUNDED 1802

January 10, 1976

Mr. Byron G. Walker
LTC. Corps of Engineers
Deputy District Engineer
Department of the Army
Buffalo District
1776 Niagara Street
Buffalo, New York 14207

Dear Mr. Walker:

We enclose herewith our master plan, existing zoning ordinance together with amendments for your information and reference in accordance to your letter sent to me on December 10, 1975.

Sincerely yours,

John T. O'Brien, Chairman
Town of Batavia Planning Board

JTO:w
encs.

# DEPARTMENT OF PLANNING

# PLANNING BOARD

3837 WEST MAIN STREET ROAD
BATAVIA NEW YORK
PHONE (716) 343 1182

Gail Seamans CHM.
Dominic Mancuso V. CHM.
Dwight Wells DIR

December 16, 1975

Mr. Byron G. Walker
LTC, Corps of Engineers
Deputy District Engineer
1776 Niagara Street
Buffalo, New York 14207

Dear Mr. Walker:

Thank you for the information on the flood management control proposal for the Tonawanda Creek Watershed.

Alternatives 1 and 2 do not directly affect land in Genesee County. However, alternative 2 is important to our county because of its creation of a source of water which could be used in developing a countywide water supply system. We also feel that alternative 2 would provide necessary control of the level of the Tonawanda Creek as it flows north so as to reduce the spring flooding in lands in the Towns of Bethany and Alexander.

Alternative 3, which is on the Tonawanda Game Management Area, does not conflict in any way with land use planning as seen by the county planning department. We favor further development and resource conservation measures in the Tonawanda Game Management Area so as to maximize the opportunity for wildlife management and public utilization of that area for conservation/education activities.

Alternative 4,entitled the Batavia Reservoir Compound, does affect a rather substantial amount of land in the Town of Bethany. Present land use plans call for continuation of this land as agricultural. As examination would show that the creation of these compounds would reduce the annual flooding of the more extensive lands in the Towns of Bethany and Alexander, the county planning board would be supportive of such an approach. We also feel that the creation of these compounds could create a recreational area usable by people from all over Western New York. We feel that from a cost benefit analyses that alternative 4

should be given priority from the corps.

The proposal outline in alternative 5 would seem to fit nicely with alternative 4 for an overall program of flood control and recreational development for the area along the Tonawanda in the City and Town of Batavia.

We would appreciate receiving any further information as it becomes available and would be more than happy to work with the corps as it nears implementation of one or more of the alternatives.

Sincerely yours,

Dwight M. Wells

Dwight M. Wells, Director
Genesee County Dept. of Planning

DMW:vmm

# County of Erie

EDWARD V. REGAN
COUNTY EXECUTIVE

**DIVISION OF PLANNING**

CHARLES O. BROWN
DIRECTOR

PHONE 716 846-8390

December 17, 1975

Bryon G. Walker, Deputy District Engineer
Department of the Army
Buffalo District Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Dear Ltc. Walker:

This is written in reference to your letter of December 1, 1975 regarding a draft environmental impact statement on a preliminary feasibility report entitled "Buffalo Metropolitan Area, New York, Water Resources Management Interim Report on Feasibility of Flood Management in the Tonawanda Creek Watershed."

You have requested basic information in knowing whether or not the various project alternatives will conform or conflict with the various land use plans, policies, controls, etc. of the indicated area.

In our evaluation of the various town master plans and zoning regulations of the effected towns in Erie County, the project should have no significant control on Erie County. None of the recommended alternates appear to have any detrimental effects upon land use development in this area, and the reduction of possible flood damage and the improvement of water quality will be beneficial.

Sincerely,

CHARLES O. BROWN
Director

sm

ERIE & NIAGARA COUNTIES REGIONAL PLANNING BOARD

Leo J. Nowak, Jr.
DIRECTOR

Donald P. Lane
CHAIRMAN
Susan R. Green
VICE CHAIRMAN
H William Fede
SECRETARY

December 18, 1975

Byron G. Walker
LTC, Corps of Engineers
Deputy District Engineer
1776 Niagara Street
Buffalo, New York 14207

Dear Colonel Walker:

Thank you for your letter of December1, 1975 requesting our comments and input to the Environmental Impact Statement on Flood Management in the Tonawanda Creek Watershed.

We are enclosing herewith a copy of the statement submitted by the Utilities Committee of the Regional Planning Board and given at the November 20, 1975 public meeting in Batavia, New York.

On November 18, 1975 Colonel Hughes wrote a letter regarding our presentation of the Tonawanda Creek Watershed Storm Drainage Proposals as recommended in our "Storm Drainage Management Plan", a copy of which the Buffalo District has in its files.

The Utilities Committee is meeting on December 18 at 10:00 a.m. in the Grand Island Town Hall. The committee will be reviewing this letter and has asked Colonel Hughes to attend their meeting to further discuss the differences between the Corps proposals and the RPB proposals and the problems caused through separate presentations. The Utilities Committee holds open meetings and anyone is free to attend. Should you desire to attend along with Colonel Hughes, please feel free to do so.

Very truly yours,

Leo Nowak

Leo J. Nowak, Jr., Director

LJN:meg
Encs.

Statement from the Utilities Committee of the Erie and Niagara Counties Regional Planning Board Regard the U. S. Army Corps of Engineers Alternative Plans for Flood Control on Tonawanda Creek to be given at the Public Meeting in Batavia on November 20, 1975

My name is Robert Floyd and I am here representing the Utilities Committee of the Erie and Niagara Counties Regional Planning Board.

The Board has completed a Storm Drainage Study covering the major watersheds of Erie and Niagara Counties. This study was funded by a grant from the U. S. Dept. of Housing and Urban Development. The region was divided up into 15 major watersheds, one of which is the Tonawanda Creek Watershed which the Corps of Engineers has presented here tonight. We are presently in the process of showing alternative solutions to the flooding problems as determined by the study and requesting public comments thereon.

On completion of the public presentations, the RPB expects to adopt a storm drainage plan and program consisting of a map and a report covering both Erie and Niagara Counties.

The plan and program now being presented by ENCRPB for Tonawanda Creek consists of a recommended plan and 4 alternatives, which identifies areas in need of flood protection in Erie and Niagara Counties along Tonawanda Creek.

The recommended plan calls for a two phase program the 1st phase being the construction of a floodway or diversion channel from the Barge Canal east to Transit Road with levees along Transit Road to divert the Black Creek flow to the diversion channel. Second stage construction will extend the diversion channel from Transit Road east to Tonawanda Creek with another levee in the

construction of the Alabama Pools should the need ever arise. Land use controls are also included in this solution.

Alternative No. 1 consists of individual protection such as construction allowed only above the 100 year flood level and then through the use of detention ponds by the developers to prevent further damages downstream due to the increased runoff generated.

Alternate No. 2

Excavation of Existing Channel: Tonawanda Creek would be deepened upstream from Mud Creek (mile 13.0 to 13.6) and near Rapids (mile 17.6 to 19.4). Low levees would be constructed across the Tonawanda-Black Creek Divide near Beeman Creek.

Alternate No. 3

Excavation of Existing Channel Combined with Alabama Pools: Alternative 2 would be combined with two inches of flood control storage over the upper Tonawanda Creek Watershed in the proposed Alabama Pools. The proposed Alabama Pools are located on the Erie-Genesee County line off-channel north from Tonawanda Creek. Low levees would be constructed across the Tonawanda-Black Creek divide.

Alternate No. 4

Complete Flood Plain Zoning: The entire broad flat flood plain would be used for non-flood vulnerable use.

In reviewing the U. S. Army Corps of Engineers alternative projects, we note the following:

1. The addition of the Batavia reservoir a solution which was not studied

2. The Alabama Pools solution but with modifications to the present Batavia Flood Control Project and without the levee and channelization projects in the Towns of Clarence and Newstead in Erie County.

3. The addition of Sierks and Linden Reservoirs a possible solution but with less protection especially in the downstream reaches.

4. The Alabama Pool solution but with Sierks Reservoir in lieu of the downstream levees and channelizations.

5. The no action and no structural action alternatives have been ruled out because they fail to meet the flood protection needs of the watershed.

The Utilities Committee of the RPB would like to go on record here tonight that the Corps of Engineers include in the next step of the study process the following:

1. Inclusion of the two phase Black Creek Diversion Channel Alternative as recommended in the RPB's Storm Drainage Management Study. This Study shows $27[illegible], 000 annual cost versus $365, 000 for the proposed study presented here tonight.

2. Inclusion of the no action alternative as required by the NEPA act.

3. The Alabama Pools alternate with the use of levees and channelization as shown in the RPB's Storm Drainage Study as an alternative to its recommended plan.

4. That the corps define the 100 year flood prone area and indicate through mapping the areas which will be no longer flooded for each of the alternatives studied.

The Committee is concerned that certain areas are developed and are developing in Erie and Niagara Counties and in order to place sufficient information in the hands of the residents affected that all alternatives possible and their impact be clearly defined so that adequate public opinion can be secured and a final solution justified to the satisfaction of the public.

The Utilities Committee thanks the Corps for the opportunity to present this statement and also expresses a continuing interest in the project and desires to participate to its fullest extent. Thank you Col. Hughes.

# ORLEANS COUNTY PLANNING BOARD

**Court House Square**
**Albion, New York 14411**

Mr. Byron G. Walker
LTC, Corps of Engineers
Deputy District Engineer
Buffalo District
1776 Niagara St.
Buffalo, N.Y. 14207

Dear Mr. Walker:

This is in response to your December 1 letter to Mr. Pahura regarding the Tonowanda Creek Watershed Management Feasibility interim report.

We appreciate your willingness to let us respond although this proposed flood mangement program has a relatively minor impact on Orleans County.

The only proposed area of impact involves lands in the extreme southwest corner of our county where Niagara and Genesee Counties abut Orleans.

Most of the land in question is part of the Oak Orchard Swamp and is under federal management. The County Planning Board's Preliminary Land Use Plan calls for continued protection of these lands as a natural wildlife refuge. Other areas, adjacent to Oak Orchard Swamp are designated as resource management areas.

The Shelby Township zoning ordinance designates other adjacent areas as agricultural use districts. However, the residential use district is defined in the ordinance as follows: "...For the purpose of this Ordinance those lands in the Agricultural Use Districts which are adjacent, opposite or within three hundred (300) feet, measured along the road frontages on both sides of the road, to a premise on which a one or two family dwelling, other than a farm dwelling, has been or may in the future be established shall be a Residential Use District and shall be subject to the provisions of this Ordinance applicable to the Residential Use Districts."

In effect this ordinance allows for and encourages the strip development of all roadways in the Town of Shelby. The County Planning Board opposes strip development of any nature. However, it is a fact of which you should be cognizant as it appears there are local roadways which are located in that area of Orleans County which was defined in Plate 1 of your interim report.

To date I have not had the opportunity to involve the Town of Shelby in any of my deliberations on this matter but I feel it proper that you also give the Town an adequate opportunity to respond if you have not already done so.

If I can be of any further assistance feel free to contact me.

Sincerely,

Geoffrey C Astles

Geoffrey C. Astles
Planner

GCA:dc

# APPENDIX C

ECONOMIC DATA EXTRACTED FROM U. S. ARMY CORPS OF ENGINEERS FINAL FEASIBILITY REPORT, BUFFALO METROPOLITAN AREA, WATER RESOURCES MANAGEMENT, *TONAWANDA CREEK* WATERSHED. COMPLETE DOCUMENT IS AVAILABLE AT U. S. ARMY ENGINEER DISTRICT, BUFFALO, NY

COSTS

C1. First Cost - Cost estimates for the Batavia Reservoir Compound (Modified), as summarized in the tables that follow, are of sufficient detail to support the conclusions drawn during the formulation stage of planning. More detailed cost estimates will be made during Phase I and Phase II General Design Memorandum studies. The estimates of first cost include costs for properties and construction costs. The estimate of costs for lands, easements, and structures are based upon current market values. The estimate of construction costs is based upon costs for similar construction projects adjusted to June 1981 price levels. Table C1 presents total property costs; Table C2 presents construction costs, and Table C3 summarizes total costs and presents the total investment costs.

C2. Average Annual Costs - The estimated investment and annual charges for the Batavia Reservoir Compound (Modified) are presented in Table C4. It is estimated that two construction seasons will be required to build the project. Annual charges on investments are derived by application of an interest rate of 7-5/8 percent on total investment costs. The average annual operation, maintenance, and major repair (OM&R) costs for the project were developed by considering data on OM&R costs from other similar Corps of Engineers projects. The OM&R costs include the services of a permanent staff to operate the dams, temporary seasonal employees, and the costs of land management, equipment, normal repairs, periodic major repair, and engineering services.

BENEFITS

C3. Benefit Categories - Benefits for flood management in the Tonawanda Creek Watershed include the following categories: Agricultural Damage Reduction, Urban Damage Reduction, Agricultural Intensification, Projected Growth of Future Agricultural Benefits, and Urban Affluence.

C4. Agricultural Intensification - Agricultural intensification benefits result from two factors: (1) an extension of the effective growing season, which will enable farmers to plant earlier in the spring, due to the elimination of most April floods; and (2) a change in farmers behavior toward more intensive agriculture.

C5. Projected Growth of Future Agricultural Benefits - This benefit is derived from the fact that the value of agricultural output on the flood plain has been rising and is expected to rise in the future.

C6. Agricultural Damage Reduction - This benefit category is attributed to the value of reducing flood losses to agricultural activities which occur in the flood plain currently and are susceptible to flooding.

C7. Urban Damage Reduction - This benefit category is attributed to the value of reducing flood losses to existing structures and contents which exist in the flood plain currently and are susceptible to flood damage.

C8. Affluence Factor - The benefit calculated as affluence factor is the increase in average annual residential flood reduction benefits attributed to increasing regional per capita income on the constant dollar value of real property and contents in the flood plain. The extent of this benefit is determined by the existing relationship between the estimated value of residential structures and contents in the flood plain and the rate of growth in regional per capita income.

C9. Benefit Summary - A summary of the average annual benefits attributed to the various categories described for the Batavia Reservoir Compound (Modified) is presented in Table C5.

C10. Economic Evaluation - Table C6 compares the costs and benefits attributed to the Batavia Reservoir Compound (Modified).

Table C1 - Estimated Property Costs for Batavia Reservoir Compound (Modified)

Upper Reservoir

| Item | Estimated Quantity | Unit | Estimated Cost |
|---|---|---|---|
| | | | $ |
| Land (fee title) | 50 | Acre | 29,000 |
| Fish and Wildlife Compensation Lands (fee title) | 350 | Acre | 82,000 |
| Land (permanent easement) | 1,158 | Acre | 386,000 |
| Buildings, Commercial and Farms | 3 | Each | 81,000 |
| Buildings (residential) | 9 | Each | 273,000 |
| Component Total | | | 851,000 |

Lower Reservoir

| Item | Estimated Quantity | Unit | Estimated Cost |
|---|---|---|---|
| | | | $ |
| Land (fee title) | 45 | Acre | 33,000 |
| Fish and Wildlife Compensation Lands (fee title) | 361 | Acre | 82,000 |
| Land, Reservoir (permanent easement) | 2,474 | Acre | 571,000 |
| Land, Spillway (permanent easement) | 1,616 | Acre | 455,000 |
| Buildings (residential) | 37 | Each | 1,359,000 |
| Buildings (Commercial and farms) | 9 | Each | 174,000 |
| Component Total | | | 2,674,000 |

Summary

| Item | Amount |
|---|---|
| | $ |
| U. R. Component Total | 851,000 |
| L. R. Component Total | 2,674,000 |
| Total | 3,525,000 |
| Property Acquisition | 1,530,000 |
| Relocation | 825,000 |
| Contingencies and Damages | 917,000 |
| Total Property Cost | 6,797,000 |

Table C2 - Estimated Construction Costs for Batavia Reservoir Compound (Modified)

| Item | Amount |
|---|---|
| | $ |
| **Upper Reservoir** | |
| Earth Dam and Emergency Spillway | 5,218,715 |
| Principal Outlet Works | 896,345 |
| Hydro-Meteorological Data Network System | 68,200 |
| Miscellaneous Work | 768,590 |
| Total | 6,951,850 |
| **Lower Reservoir** | |
| Earth Dam and Emergency Spillway | 3,448,245 |
| Principal Outlet Works | 839,905 |
| Training Dikes | 499,370 |
| Highway Relocation | 47,760 |
| LVRR Bridge Removal | 167,295 |
| Miscellaneous Work | 631,100 |
| Total | 5,633,675 |

Summary

| Item | Amount |
|---|---|
| | $ |
| U. R. Component Total | 6,951,850 |
| L. R. Component Total | 5,633,675 |
| Plan Subtotal | 12,585,525 |
| Contingencies (20%) | 2,514,475 |
| Total Direct Cost | 15,100,000 |
| Engineering and Design (10.5%) | 2,300,000 |
| Supervision and Administration (8.5%) | 1,600,000 |
| Total Construction Cost | 19,000,000 |

Table C3 - Summary of Estimated Costs for Batavia Reservoir Compound (Modified)

| Item | Amount |
|---|---|
| | $ |
| Property | 6,800,000 |
| Construction | 19,000,000 |
| Total | 25,800,000 |

Table C4 - Investment Costs and Average Annual Costs for Batavia Reservoir Compound (Modified)

| Item | Amount |
|---|---|
| | $ |
| Investment Costs | |
| Property 1/ | 6,800,000 |
| Construction | 19,000,000 |
| Interest During Construction (7-5/8%) 2/ | 1,600,000 |
| Total | 27,400,000 |
| Average Annual Costs | |
| Interest (7-5/8%) | 2,089,000 |
| Amortization (0.00007) | 1,000 |
| Operation and Maintenance | 400,000 |
| Total | 2,490,000 |

1/ Includes land (fee simple) and total property acquisition costs.
2/ Assuming a 2-year construction period.

Table C5 - Summary of Average Annual Benefits, Batavia Reservoir Compound (Modified)

| Benefits | Amount |
|---|---|
| | $ |
| Agricultural Damage Reduction | 443,900 |
| Urban Damage Reduction | 1,676,600 |
| Future Agricultural Benefits | 1,000,300 |
| Urban Affluence | 169,700 |
| Total | 3,290,500 |

Table C6 - Batavia Reservoir Compound (Modified), Economic Evaluation

| Benefits | Amount |
|---|---|
| | $ |
| Average Annual Benefits | 3,290,500 |
| Average Annual Costs | 2,490,000 |
| Net Benefits | 800,500 |
| Benefit/Cost Ratio | 1.32 |

# APPENDIX D

## PAST ACTIONS TO CONTROL FLOODING ON TONAWANDA CREEK, EXTENT OF FLOODING AND FLOOD DAMAGE PHOTOGRAPHS

D1. Introduction - This final environmental impact statement regarding flood management in the Tonawanda Creek Watershed, NY, has been prepared by the Buffalo District Corps of Engineers in accordance with the National Environmental Policy Act of 1969 (NEPA), Public Law 91-190. The proposed project is described in this document in terms of feasibility findings only, which are the result of two stages of a feasibility study. Additional stages of implementation study (General Design Memorandum) would be accomplished before the considered project could be constructed. However, the considered project must be authorized and funded by Congress before these additional stages of study can be undertaken. If the proposed action is authorized and funded, the General Design Memorandum studies (GDM) would be accomplished. During the first phase of the GDM study, data presented in the environmental impact statement prepared for the Final Feasibility Report would then be reviewed; and, if necessary, supplemental information obtained through further environmental studies. During the GDM study phase, an environmental assessment would be prepared to determine need for preparation of an updated environmental impact statement and need for incorporation of any additional results of biological and cultural resource studies, together with the most current project description changes, if any.

D2. Department of Army regulation ER 200-2-2 requires that a 30-day review period (by interested agencies, groups, and individuals) will follow issuance of a final environmental impact statement, beginning with the date of publication of the final environmental impact statement by the U. S. Environmental Protection Agency in the Federal Register. Lack of written response by interested agencies, groups, and individuals during the review period may be presumed to indicate that the party consulted has no objections to the considered project.

D3. Prior Corps Actions on Tonawanda Creek - Since 1888, the Corps has completed several structural actions on Tonawanda Creek and Harbor including construction and maintenance of a channel 16,800 feet long, 400 feet wide, and 16 feet deep for the Tonawanda Inner Harbor; and a channel 1,400 feet long, 180 feet wide, and 16 feet deep for Tonawanda Creek from its mouth upstream to State Route 265. In 1956, the Corps completed a structural measure which included minor clearing of the Tonawanda Creek channel from the Lehigh Valley Railroad Bridge near the southern limit of the city of Batavia, to a municipal dam on the Creek near the center of the city; removal of an abandoned bridge pier in this reach; widening and shaping of the Creek channel over a distance of approximately 2 miles from the municipal dam downstream; and protection of the left channel bank between Oak and Walnut Streets. In 1958 and 1959, the Corps expended $75,000 to clear and snag the lower 7-mile reach of the Ellicott Creek tributary in the town of Amherst. Since this work was completed, local interests have maintained the reach. In 1975, the Corps expended $7,200 to remove a debris-jam from the Tonawanda Creek channel in the town of Alexander.

D4. Prior Studies and Actions by Others on Tonawanda Creek - In August 1966, the Division of Water Resources, of the since reorganized New York State Conservation Department, reported on several reconnaissance studies to collect information for use in planning, developing, and managing the water resources of the State, including those of Tonawanda Creek Watershed. In

1967, the Division of Water Resources completed a report summarizing the findings presented in the reconnaissance reports.

D5. In December 1969, the Erie-Niagara Basin Regional Water Resources Planning Board reported on a comprehensive study of water resources management needs in the Erie-Niagara Basin which includes the Tonawanda Creek Watershed. Four plans were recommended to meet the water management needs in the Tonawanda Creek Watershed - one providing for improvement in the Ellicott Creek Watershed, and three providing for improvement in the remainder of the Tonawanda Creek Watershed. The plan of improvement in the Ellicott Creek Watershed provided for construction of a multi-purpose reservoir on Ellicott Creek near the village of Alden, and complementary dikes and channel improvement. The plans for improvement in the remainder of the Tonawanda Creek Watershed provided for construction of two multi-purpose reservoirs, one on Tonawanda Creek near the hamlet of Sierks and one on a tributary, Little Tonawanda Creek, near the hamlet of Linden, and a group of eight associated multi-purpose reservoirs in the Tonawanda Game Managemmnt Area New York Conservation Department adjacent to Tonawanda Creek near the hamlet of Alabama. None of these plans were implemented. In June 1974, the Erie and Niagara Counties Regional Planning Board completed a report on a study of storm drainage (flood management) needs in Erie and Niagara Counties which includes much of the Tonawanda Creek Watershed. The report recommended: construction of a floodway to extend roughly 7 miles upstream from Tonawanda Creek near its junction with Ransom Creek in the town of Amherst, generally parallel to Black Creek, to Tonawanda Creek near its junction with Beeman Creek in the town of Clarence; reservation of land in the Oak Orchard Swamp near Alabama for possible floodwater storage; flood plains regulation in the lower part of the Watershed expected to be flooded more often than once in 10 years, including zoning to limit their development to nonflood vulnerable use and to eliminate nonconforming uses; and, enlargement and realignment of the channel of Bull Creek over a distance of 6 miles from near the village of Martinsville in the town of Wheatfield, upstream into the town of Cambria. The recommended plan has not been implemented.

D6. The Great Lakes Basin Commission, comprising representatives of interested Federal agencies and States within the Great Lakes Basin, has prepared a comprehensive study to develop land and water resources within the basin, which includes the Tonawanda Creek Watershed. The function of the Commission is to determine and recommend water and land resources management priorities within the Great Lakes Basin. The Commission does not actually implement plans for development, but rather advises others, such as the Corps, who do. The report, completed in 1976, contains general recommendations for the Tonawanda Creek Watershed.

D7. In 1825, the State of New York completed the Erie Canal (later modified and renamed the New York State Barge Canal) to provide a navigable water route from Lake Erie to the Atlantic Ocean. The Canal and Tonawanda Creek channel are one and the same from the mouth of the Creek on the Niagara River to near the hamlet of Pendleton, a distance of 12-1/2 miles. Near Pendleton the canal was constructed on a northerly course to pass from the Tonawanda Creek Watershed through the city of Lockport. Presently, the canalized reach of the Tonawanda Creek channel has capacity to conduct flows likely to be

exceeded no more frequently than on the average of once in 100 years. In 1860, New York State completed construction of a ditch to drain the western part of Tonawanda Swamp north of the city of Batavia. In 1900, New York State spent $4,000 to clear the Tonawanda tributary channels of Beeman, Black, Ransom, and Got Creeks. In 1901, New York State spent $8,600 to clear, widen, and deepen the tributary Mud Creek channel over a distance of approximately 20,000 feet. Prior to 1915, New York State tax law provided that peoples' taxes could be paid by working on roads and ditches. Therefore, prior to 1915, natural drainage channels in the lowlands of the Watershed were improved and maintained and many artificial channels were constructed and maintained by the State of New York and local agencies. In 1916, structural changes were made in the New York Barge Canal which included removal of a dam at Tonawanda. Since that time, high discharges have caused relatively little damage in Tonawanda and North Tonawanda.

D8. In 1938, the city of Batavia removed an unused mill dam across Tonawanda Creek in the village of Bushville. Some time prior to 1942, the city of Batavia constructed a levee in the vicinity of Kibbee Park along Tonawanda Creek near the southern limit of the city. In 1942, a flood of probable 7 year frequency overtopped this levee and spread throughout the southern part of the city to cause widespread damage. In 1940 and 1943, New York State straightened Tonawanda Creek channel between the city of Batavia and village of Bushville.

D9. In 1965, Erie County constructed a flood diversion channel through Ellicott Creek Park in the town of Tonawanda to connect the channels of Ellicott and Tonawanda Creeks. The diversion serves to divert peak flows from Ellicott Creek to Tonawanda.

D10. Over a period of years, prior to 1973, segments of floodwalls have been constructed or reconstructed along both banks of Tonawanda Creek within the village of Attica. These floodwalls are situated roughly opposite each other, and extend from an embankment of Erie Railroad, downstream past State Route 268, (Main Street Bridge). The wall on the left side extends a total of 400 feet; that on the right extends a total of roughly 450 feet. In 1973, the floodwall on the right (east) bank was reconstructed by the Office of Emergency Preparedness as a result of damages which occurred during Tropical Storm Agnes.

D11. Flooding History - Most of the creeks in the Tonawanda Creek Watershed flow within their channels even during periods of high flow. Tonawanda and Mud Creeks however, flood frequently and the overflow from their channels can augment the flows of other creeks enough to cause them to flood also. Much of the runoff contributing to Tonawanda Creek is shed by the Cattaraugus Hills in Wyoming County. The soil in this area is moderately permeable glacial till which admits water readily and, thereby, tends to reduce surface runoff despite the area's steep slopes. During summer, the runoff from them is low. During winter, moisture in the soil freezes and most precipitation accumulates on the hills as snow. In early spring however, air temperatures often rise enough to melt the snow before the ground has thawed. Under these circumstances, almost all snowmelt and spring rain runoff moves immediately to Tonawanda Creek, causing a large flow increase in a short period of time.

D12. Approximately 30 thunderstorms annually produce high intensity precipitation somewhere over the Watershed. Most of these thunderstorms occur in summer when soil moisture is low; consequently, much of the rainfall produced by them infiltrates into soils of the Watershed. However, thunderstorms occur in spring and early summer when soil moisture of the Watershed is either still frozen or high enough to inhibit infiltration, with the result that flooding occurs.

D13. Floods of Record - Major floods of Tonawanda Creek occurred in March 1904, March 1916, March 1942, March 1956, January 1957, and March 1960. The 1904 and 1916 floods caused considerable damage in the lower part of the Tonawanda Creek Watershed in the cities of Tonawanda and North Tonawanda. The configuration and structures of the Barge Canal in the vicinity of the two cities were changed in 1916 and high discharges have caused relatively little damage in the cities since. The 1960 flood had a record peak discharge of 8,000 cfs at the Alabama, NY, gaging station, and caused an estimated $1,500,000 in flood damages. According to a Buffalo District post-flood report, 450 residential units, 48 commercial units, 250 agricultural units, and an undetermined number of roads and public facilities were affected by the flood. In the past, major flooding has occurred in the spring and has been caused by snow-melt augmented by rainfall. Major flooding caused by ice jams in Tonawanda Creek has been rare.

D14. Extent of Flooding - Flooding by the lower reaches of Tonawanda, Mud, and Ransom Creeks, upstream of the Tonawanda Creek confluence with the State Barge Canal, often inundates vast area of low, flat land. This type of flooding extends upstream nearly 30 miles to the Tonawanda Indian Reservation. The flood plains of the three creeks merge in some areas and reached a maximum width of about 4 miles during the 1960 flood. From the Tonawanda Indian Reservation upstream to the village of East Pembroke, flooding is generally restricte. to the narrow overbank areas. From the village of East Pembroke to t . city of Batavia, the flood plain varies in width from 500 to 1,500 feet. Above the city of Batavia, the flood plain widens to occupy a large lowland area extending upstream about 6 miles to the village of Alexander. This area reached a maximum width of about 12,000 feet during the 1960 flood. From the village of Alexander to the village of Attica, the flood plain varies in width from 1,000 to about 2,000 feet. Above the village of Attica flooding is minimal, (see Plate D1).

D15. The characteristics of the watershed are such that typically the time required for a flood peak to travel from the city of Batavia to the confluence with the Barge Canal is several days. During the 1960 flood, the travel time was about three days. Once flooded, the lowlands on either side of the creek may remain inundated for several weeks, functioning as a natural storage area that considerably reduces downstream discharges. During major floods, water from Tonawanda Creek leaves the channel and flows parallel to the channel in areas both north and south. Often in the overbank areas, the flood elevations are higher than in the creek channel. Parallel flow on the north bank first occurs near Ditch Road and finally returns to the main stream near Rapids. The banks of Tonawanda Creek in several reaches are higher than the adjacent flood plain. During major floods, overbank flooding occurs and water flows parallel to Tonawanda Creek leaving high ground

between the creek and the area being flooded. This situation first occurs near Ditch Road, and the flood water finally returns to the main Tonawanda Creek channel near the hamlet of Rapids, NY. Parallel flow along the south bank occurs in the area near Beeman Creek and eventually reaches the watersheds of Ransom, Black, and Got Creeks before returning to the main stream, (see Plate D1). Flooding and soil erosion have been problems in the Tonawanda Creek Watershed for many years. The recent increase in development of forest and farm land for industrial and residential use has increased the long-standing need for flood management in the area. Plates D2 to D5 illustrate the extent and damages caused by past floods of Tonawanda Creek.

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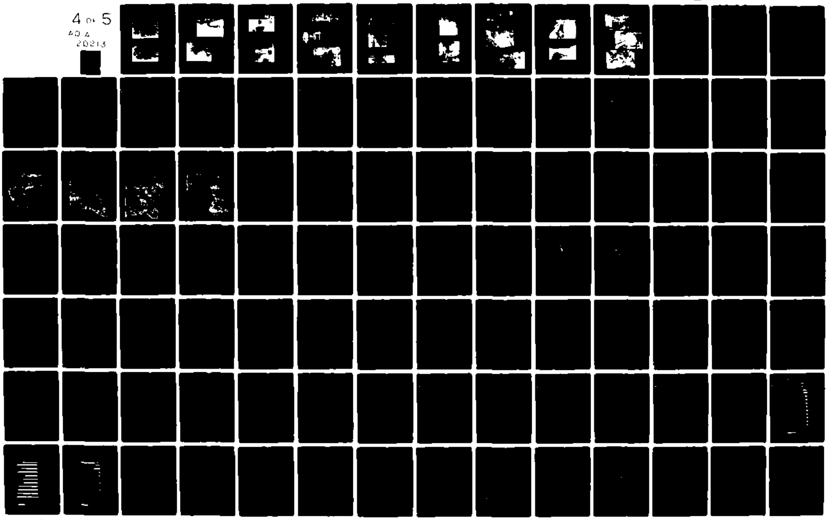



Photo 1. Aerial view of flooding during the 1960 flood, in the vicinity of Burdick Road, roughly 3-1/2 river miles above mouth of Beeman Creek.


Photo 2. Extensive flooding during the 1960 flood in the vicinity of Tonawanda Creek, Black Creek and Beeman Creek.

Photo 3. Aerial view of flooding along Ransom Creek in the vicinity of Millersport Highway during the 1960 flood.

Photo 4. Widespread flooding in the vicinity of Transit Road and Wolcott Road along Black Creek during the 1960 flood.

Photo 5. Person stranded in his home by flooding, roughly 2 miles from the mouth of Ransom Creek (1960).

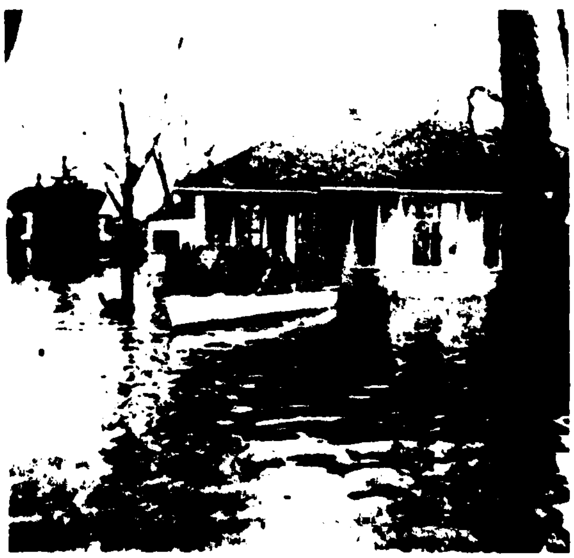


Photo 6. Rescue of residents affected by flooding along New Road, roughly 3 miles from the mouth of Ransom Creek (1960).

Photo 7. Residence at the intersection of Goodrich and Brauer Road, south of the village of Rapids (1960).

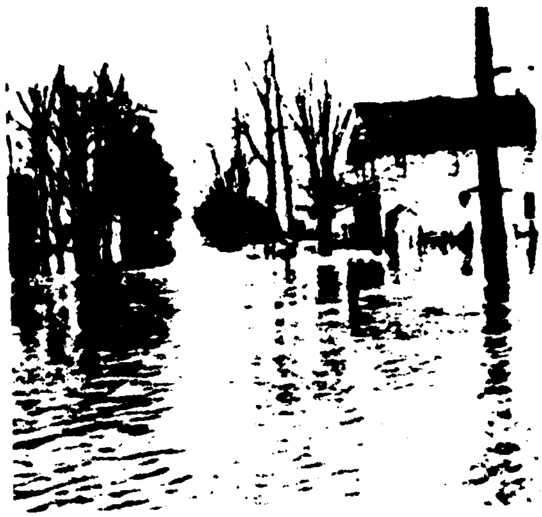


Photo 8. View, in northerly direction, along Wolcott Road, roughly 9 miles from the mouth of Black Creek (1960).

Photo 9. Flooding of residence near mouth of Ransom Creek (1960).

Photo 10. View, in northerly direction, along New Road near Ransom Creek, roughly 3 miles from its mouth (1940).

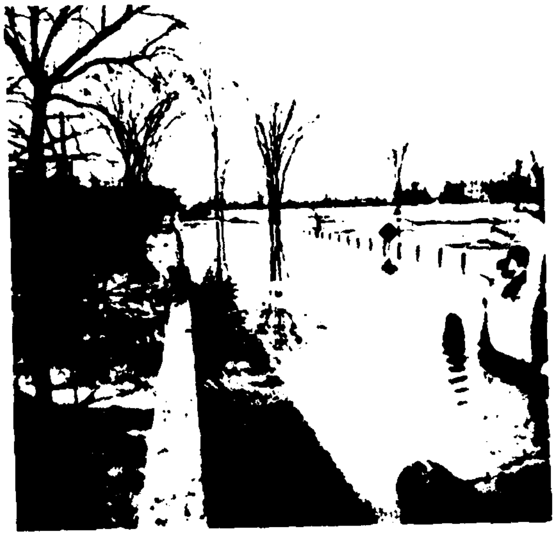


Photo 11. Persons stranded by flooding near the mouth of Beeman Creek (1954).

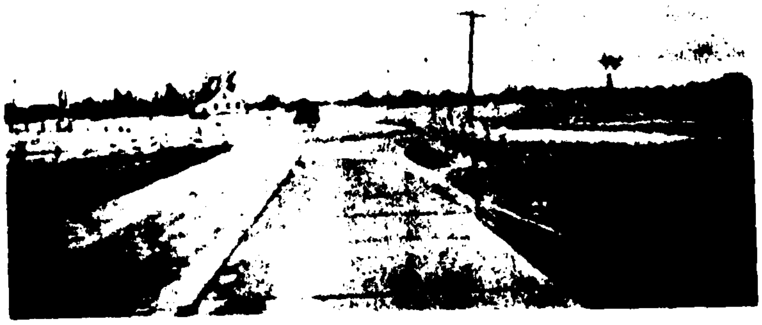


Photo 12. View, in northerly direction, along Millersport Highway near Ransom Creek, roughly 3 miles from its mouth (1940).

Photo 13. View, in easterly direction, of flooding along Railroad Avenue in village of Alexander (1956).

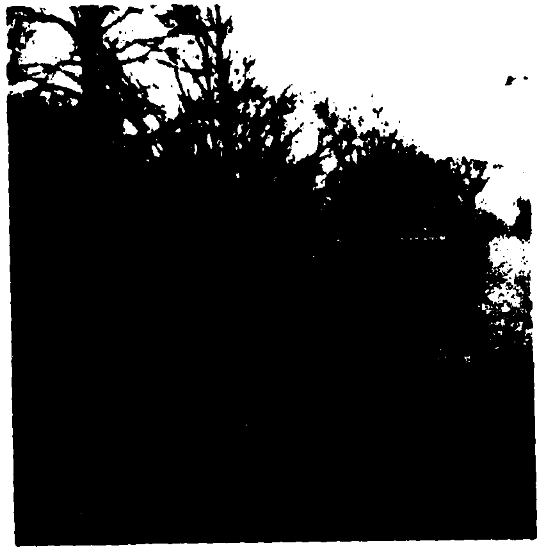
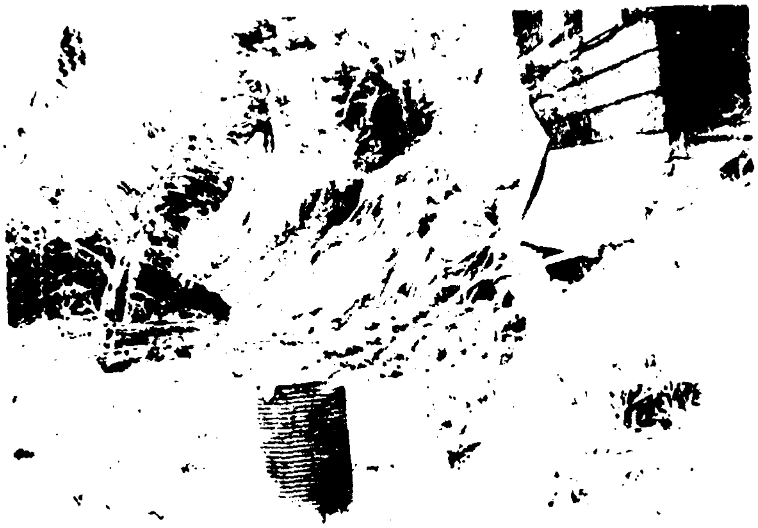
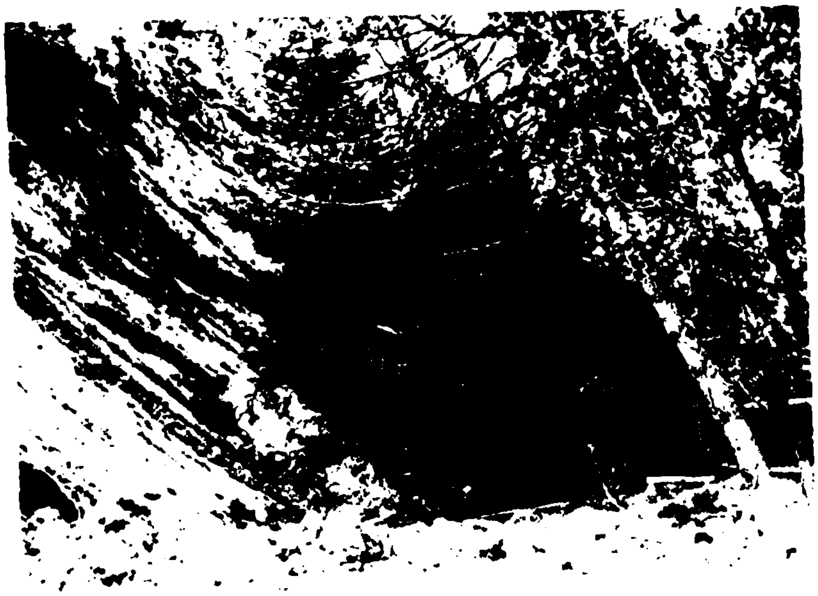


Photo 14. View of damage caused by flooding shown in Photo 13.





Photos 15 and 16. Post-flood slide of Tonawanda Creek channel bank, west of the village of Rapids (1973).

Photo 17. View of post-flood slide of Tonawanda Creek channel bank, roughly 1 mile downstream from the mouth of Mud Creek (1956).

Photo 18. Aerial view of recently eroded channel of Tonawanda Creek between the village of Alexander and the city of Batavia. (1975)

Photo 19. View of eroded channel of Tonawanda Creek near village of Attica, after flooding caused by tropical storm Agnes. (1972)

Photos 20 thru 22. Views of debris jam in Tonawanda Creek channel, downstream from village of Alexander. (1975)

# APPENDIX E

## ENVIRONMENTAL SETTING WITHOUT THE PROJECT

THIS APPENDIX PRESENTS AN ORIGINAL COPY OF CHAPTER 2 OF THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR TONAWANDA CREEK DATED MAY 1976

APPENDIX E

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## 2. ENVIRONMENTAL SETTING WITHOUT THE PROJECT

### THE NATURAL ENVIRONMENT

2.01 General - The Tonawanda Creek Watershed, an area of about 648 square miles, is located in western New York and includes substantial portions of Erie, Genesee, Niagara, and Wyoming Counties and a minute portion of Orleans County. The Watershed comprises many tributary watersheds, including those of Ellicott Creek and Bull Creek which join the mainstream, Tonawanda Creek, near its mouth of the Niagara River. Because flood management needs in the Bull Creek and Ellicott Creek Watersheds are normally independent of those in the remainder of Tonawanda Creek Watershed, studies of those needs have been accomplished separately in other reports. The area shown on Plate 2.1 encompasses about 511 square miles and includes the Tonawanda Creek Watershed less the subwatersheds of Bull and Ellicott Creeks.

### GEOLOGY

2.02 Physiography - Pertinent physiography of the Tonawanda Creek Watershed is shown in Plate 2.2. The Tonawanda Creek Watershed includes parts of two physiographic provinces; the Cattaraugus Hills south of the Portage Escarpment belong to the Appalachian Upland, while the larger portion of the Watershed north of the Portage Escarpment is part of the Erie-Ontario Lowland. The flat-topped Cattaraugus Hills stand approximately 1,800 feet above sea level and are separated by deeply eroded valleys with relatively steep sides and slopes. This part of the watershed slopes northward toward the Portage Escarpment.

2.03 The Portage Escarpment comprises a series of east-west striking strata of erosion-resistant bedrock. This escarpment crosses the watershed near the Wyoming-Genesee County line.

2.04 The Erie-Ontario Lowland part of the watershed includes much of the southern Ontario Plain lying between the Portage Escarpment and the Niagara Escarpment to the north. This plain includes two subplains, the Erie and the Huron Plains separated by the east-west striking Onondaga Escarpment.

2.05 The Erie Plain is rolling with moderate slopes. Within the watershed, the plain slopes in two directions. The eastern and greater part of the plain slopes northward from approximately 1,000 feet above sea level near the Portage Escarpment to approximately 800 feet near the Onondaga Escarpment. The western part of the plain slopes westerly from a height of approximately 1,000 feet near the Portage Escarpment in the town of Bennington to approximately 700 feet near the Onondaga Escarpment in the town of Amherst.

2.06 The Huron Plain is only slightly undulating, with flat slopes. This plain slopes westerly from a height of approximately 650 feet near the Onondaga Escarpment in the Tonawanda Indian Reservation to approximately 600 feet in the town of Tonawanda. The eastern boundary of the watershed in the Huron Plain lies near the western limit of Oak Orchard Swamp.

2.07 There are numerous natural and man-made waterways within the Tonawanda Creek Watershed. The principal natural waterways are the channels of Tonawanda Creek and its tributaries. The major man-made waterways include part of the New York State Barge Canal and the Feeder Canal. Many of the natural waterways have adequate capacities to conduct runoff from their own watersheds. However, several of them in the essentially flat Huron Plain are often subjected to overflow from adjacent watersheds. Such overflow combines with indigenous runoff to cause flow out of channel. Waterways known to have inadequate capacities under high runoff conditions are described in subsequent paragraphs.

2.08 Tonawanda Creek, the major stream of the watershed, rises in the Cattaraugus Hills in the town of Wethersfield in Wyoming County. From its source, approximately 1,930 feet above sea level, the Creek flows northward approximately 22 miles through deep valleys with steep sides and slopes to enter the Erie Plain near the village of Attica. In this reach, the Creek flows rapidly and usually well within its channel. From the village of Attica, the creek continues to flow northward for nearly 20 miles through essentially flat bottomland to the city of Batavia. The creek in this reach flows slowly and often floods during periods of high flow. In the city of Batavia, the creek's channel is turned by erosion resistant rock formations of the Onondaga Escarpment, and begins to flow westward through the Erie Plain and parallel to the escarpment. The creek in this reach continues to flow slowly and flood frequently during periods of high flow. In the town of Pembroke, near its boundary with the Tonawanda Indian Reservation, the creek breeches the escarpment approximately 2 miles to enter the Huron Plain within the Reservation. From the Reservation, the creek winds approximately 27 miles westward along the axis of the plain to its confluence with the New York State Barge Canal in the town of Pendleton. The channel of this reach contains sluggish creek flows that often floods extensively during periods of high flow. From this confluence, the creek continues to flow westward approximately 12-1/2 miles to its mouth on the Niagara River. This lower 12-1/2 mile reach was improved to serve as part of the Barge Canal; consequently, although the creek flows sluggishly here, it normally flows well within the channel.

2.09 Little Tonawanda Creek, a major tributary of Tonawanda Creek, rises in the Cattaraugus Hills in the town of Middlebury in Wyoming County. From its source approximately 1,280 feet above sea level, the creek flows northward approximately 8 miles through valleys with steep

sides and slopes to enter the Erie Plain near the hamlet of Linden. In this reach, the creek flows rapidly and stays within its channel. From the hamlet of Linden, the creek continues to flow northward for about 10 miles along a winding course, through an undulating plain to its confluence with Tonawanda Creek in the town of Batavia near the Bethany-Batavia town Town line. The channel of this reach is generally adequate. However, during periods of high flow in Tonawanda Creek, Little Tonawanda Creek often floods near its mouth.

2.10 Ledge Creek, another major tributary of Tonawanda Creek, rises near the crest of the Onondaga Escarpment in the town of Pembroke. From its source approximately 680 feet above sea level, the creek flows northwestward approximately 4 miles to enter the Huron Plain at the base of the escarpment in the town of Newstead. In this reach, the creek flows rapidly and usually stays within its channel. From the base of the escarpment, the creek continues to flow northwestward approximately 3 miles through flatland to its confluence with Tonawanda Creek in the town of Newstead. Throughout this reach, the creek flows slowly and often out of channel during periods of high flow. Near the base of the escarpment, Ledge Creek receives its major tributary, Murder Creek, which rises in the Cattaraugus Hills in the town of Bennington. From its source approximately 1,380 feet above sea level, the creek flows northward approximately 5 miles to enter the Erie Plain at the base of the Portage Escarpment in the town of Darien. From the base of the escarpment, the creek winds northwestward for about 25 miles across the Erie Plain to the crest of the Onondaga Escarpment in the village of Akron. From the village of Akron, the creek descends to the Huron Plain to join Ledge Creek.

2.11 Beeman Creek, a minor tributary of Tonawanda Creek, rises near the crest of the Onondaga Escarpment in the town of Newstead. From its source approximately 740 feet above sea level, the creek flows northwestward approximately 6 miles to enter the Huron Plain at the base of the escarpment in the town of Clarence. In this reach, the creek flows rapidly and usually within its channel. From the base of the escarpment, the creek flows northward approximately 3 miles through flat land to its confluence with Tonawanda Creek in the town of Clarence. Throughout this reach, the creek flows sluggishly and usually out of channel during periods of high flow.

2.12 Mud Creek, a major tributary of Tonawanda Creek, rises near the western periphery of the Oak Orchard Swamp in the town of Royalton. From its source approximately 600 feet above sea level, the creek winds westward approximately 18 miles through flat land of the Huron Plain to its confluence with Tonawanda Creek in the town of Pendleton. Throughout its length, the creek flows sluggishly and usually out of channel during periods of high flow.

2.13 Ransom Creek, a major tributary of Tonawanda Creek, rises near the crest of the Onondaga Escarpment in the town of Newstead. From its source approximately 745 feet above sea level, the creek flows northwestward approximately 13 miles to enter the Huron Plain at the base of the escarpment in the town of Amherst. Throughout this reach the creek usually flows within its channel during periods of high flow. From the base of the escarpment, the creek continues to flow northwestward for 4 miles through flat land to its confluence with Tonawanda Creek in the town of Amherst. The creek in this reach generally flows sluggishly and usually out of channel during periods of high flow. Near the base of the escarpment, the creek receives a major tributary Got Creek, which rises in the town of Clarence and flows northwestward for about 10 miles to its confluence with Ransom Creek. Approximately one mile downstream from its confluence with Got Creek, Ransom Creek receives a second major tributary, Black Creek, which rises in the Huron Plain in Clarence and flows westward 8 miles through flat land to its mouth. Throughout its length, Black Creek flows sluggishly and often out of its channel during periods of high flow.

2.14 Bedrock - Bedrock of the Watershed was formed during the Silurian and Devonian periods of the Paleozoic era. It includes sedimentary formations of the Lockport Group of the Middle Silurian System through the Canadaway Group of the Upper Devonian System. Outcrops of bedrock are evident in stream channels and road cuts in the watershed. The original structure of the bedrock was scoured by Pleistocene glaciation. The softer strata were easily eroded; places formerly occupied by such strata became lowlands. The harder strata resisting erosion are visible today as escarpments. Bedrock strata in the lowlands generally dip $1/2^{\circ}$ (48 feet per mile) in a southeastward direction and strike subparallel to the faces of the escarpments.

2.15 Plate 2.3 gives a general overview of bedrock geology as formed during the Peleozoic Era's Ordovician, Silurian and Devonian periods, pertinent to the Tonawanda Creek Watershed and peripheral outlying areas.

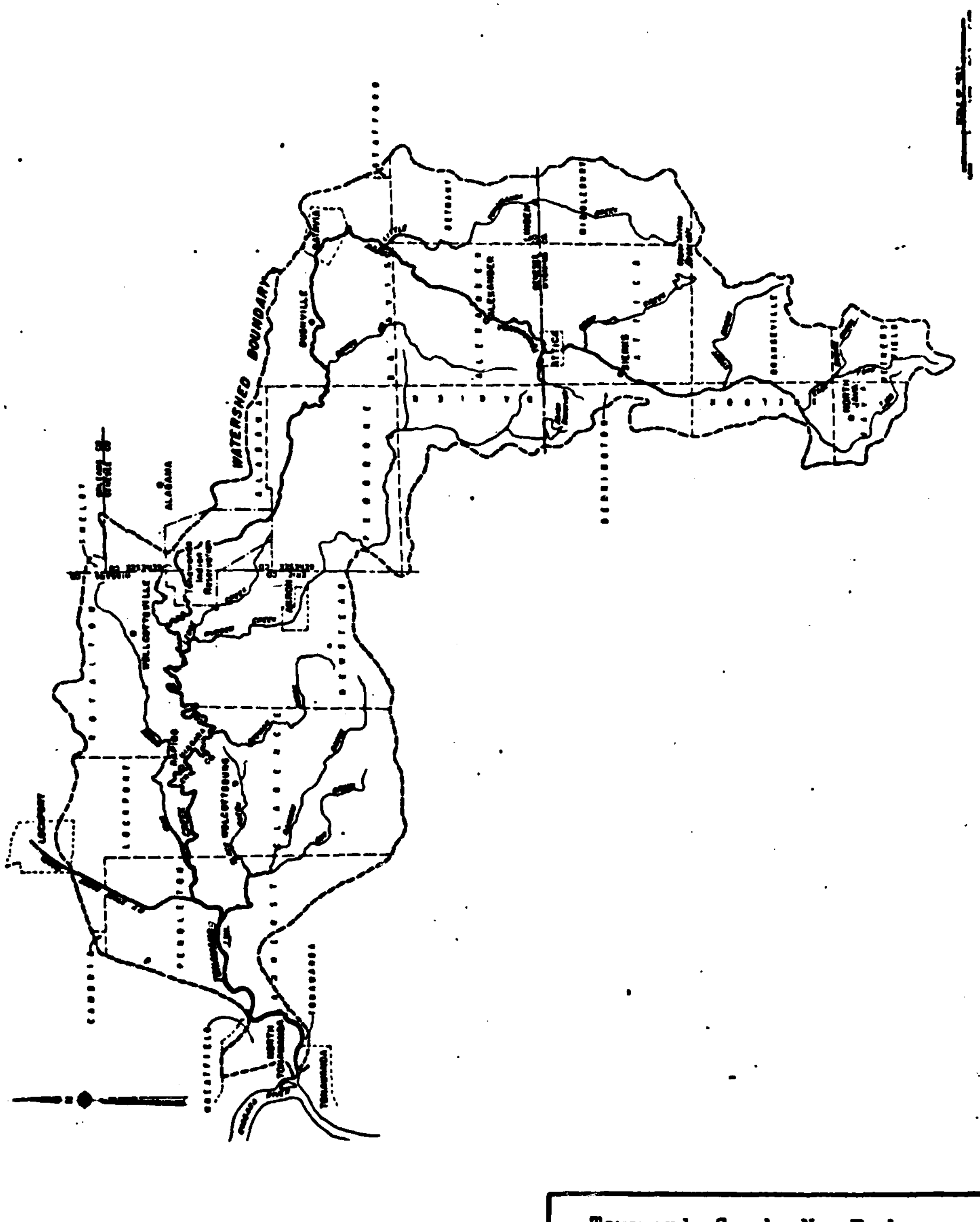
2.16 There is a large fault extending from the hamlet of Linden (southeast of the city of Batavia) to the hamlet of Cleredon (south east of the village of Albion in adjacent Oak Orchard Creek Watershed.) This thrust fault strikes north-south and has a throw of more than 100 feet. Numerous small thrust faults and superficial faults caused by mining of salt and gypsum from the substrata and surface loading, have been found in this part of the watershed.

2.17 Seismicity - The seismic risk map published by the Environmental Science Service Administration (E.S.S.A.) Coast and Geodetic Survey for the continental U.S.A. is shown on Plate 2.4, entitled "Seismic Risk Zones", divides the continent into zones according to the occurrence of earthquakes. There are four zones, numbered 0 to 3, that are based on the intensities of earthquakes and geological considerations. The Seismic Risk Zone map indicates that the Tonawanda Creek Basin is located in a zone where major destructive earthquakes may occur. The severest recorded earthquake in the Watershed, which occurred near Attica in August 1929, had an intensity of VIII on the 12-point Modified Mercali Intensity Scale of 1956.

2.18 Ground Water - Plate 2.5 shows the approximate boundary of the Erie-Niagara basin in which the Tonawanda Creek Watershed is located. Although lake deposit areas are not ground water yielding, sandy portions of these deposits may yield small supplies of water. As indicated in the Erie-Niagara Basin Ground-Water Resources report of the State of New York Conservation Department Water Resources Commission[(3)], "The Erie-Ontario lowlands are underlain mainly by till and silt and clay deposits, though some sand and gravel deposits occur near streams. The sand and gravel deposits, being permeable and giving rise to permeable soils, will accept infiltration from precipitation at a high rate. Till, clay, and silt, because of their low permeabilities, accept infiltration at a slow rate." It was noted that till being the most widespread unconsolidated deposit in the Erie-Niagara basin, has low permeability and furnishes only a small supply of ground-water.

2.19 Natural Resources - Bedrock resources in the Watershed include four non-metallic types of rocks - salt, gypsum, limestone, and dolomite. Also, there are five known fields of natural gas. Salt beds of the Silurian System underlie all of the Wyoming County part of the Watershed and the Genesee County part, upstream from the city of Batavia. Gypsum formations generally underlie the Onondaga Escarpment in the Erie, Niagara, and Genesee Counties sections of the Watershed. Closely associated limestone and dolomite formations underlie the Niagara Escarpment in Niagara and Orleans Counties and the Onondaga Escarpment in Erie and Genesee Counties. Known natural gas fields underlie isolated parts of the Watershed in Erie, Niagara, Genesee, and Wyoming counties. One field underlies parts of the towns of Attica and Bennington in Wyoming County; another underlies parts of the towns of Darien and Pembroke in Genesee County; a third underlies parts of the towns of Pembroke and Newstead in Genesee and Erie counties; a fourth underlies parts of the towns of Newstead, Alden, Clarence, and Lancaster in Erie County, and a fifth gas field underlies parts of the towns of Amherst, Tonawanda, and North Tonawanda in Erie and Niagara counties. Sand and gravel deposits generally occur in scattered areas throughout the Watershed.

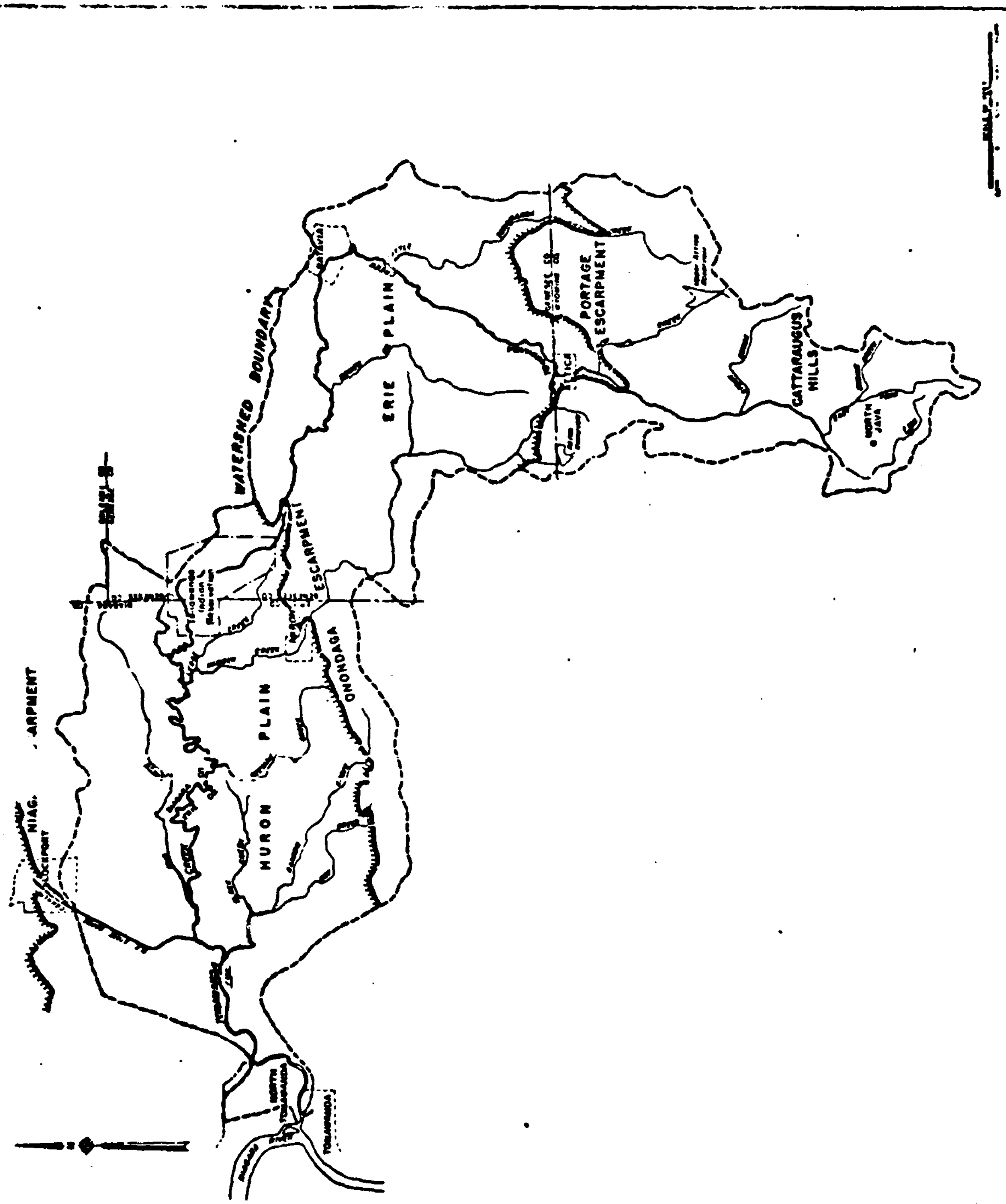
[(3)] Indicates reference number in the bibliography (Appendix G)




Tonawanda Creek, New York

**TONAWANDA CREEK**
**WATERSHED MAP**

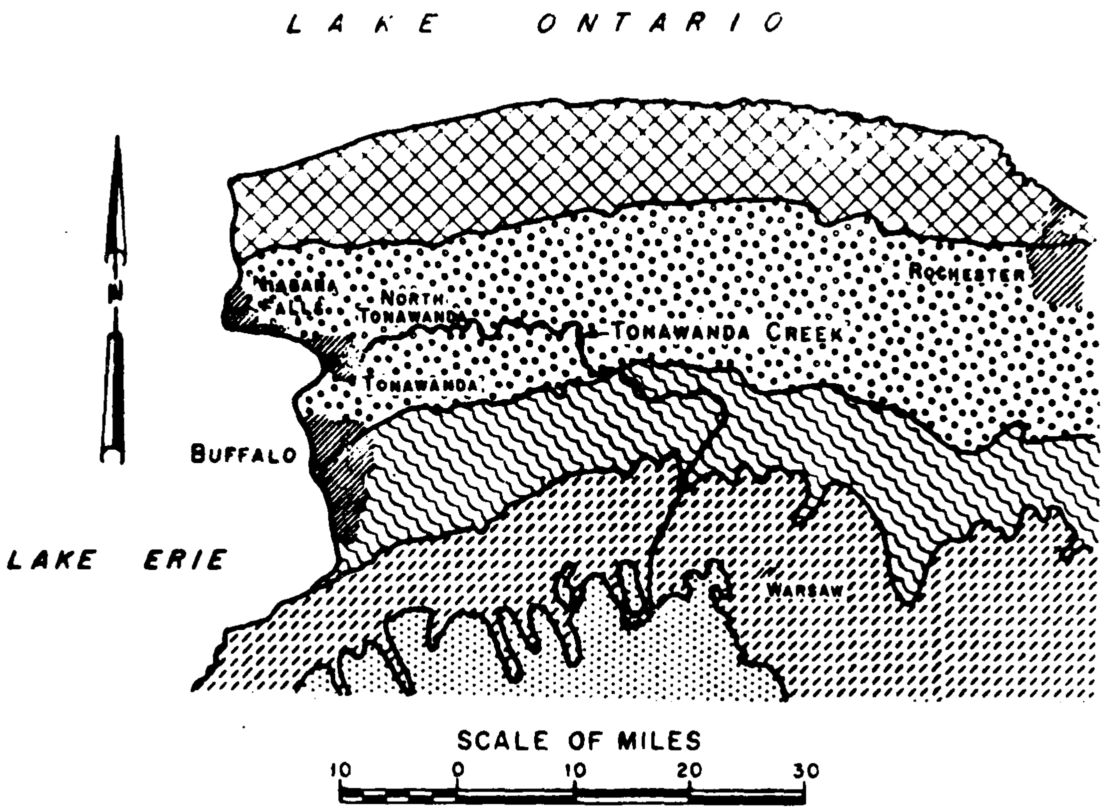
**Plate 2.1**




.Tonawanda Creek, New York

PHYSIOGRAPHY MAP
OF
THE WATERSHED

Plate 2.2




PALEOZOIC (570 - 225 MILLION YEARS AGO)

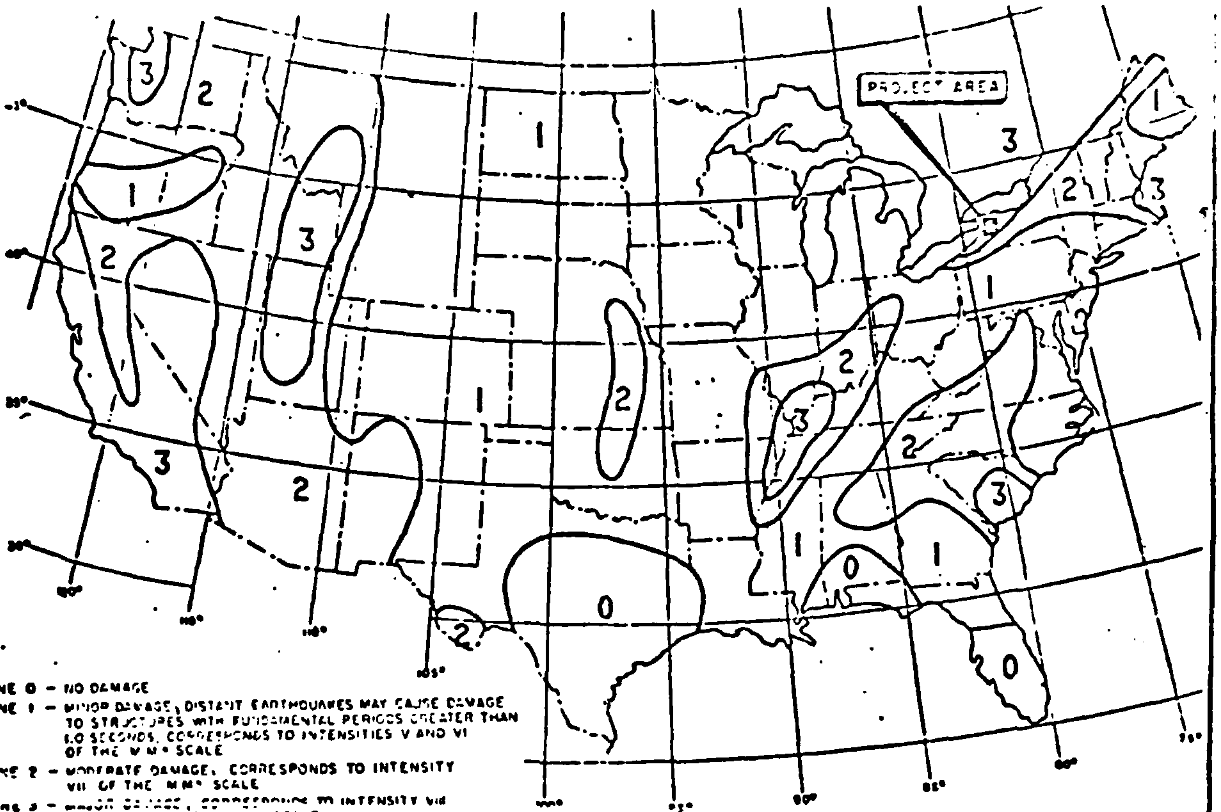
| | | |
|---|---|---|
| ORDOVICIAN | (500-435 MILLION YEARS AGO): MAINLY SHALE AND SANDSTONE IN UPPER PART, LIMESTONE AND DOLOSTONE IN LOWER. |
| SILURIAN | (435-395 MILLION YEARS AGO) DOLOSTONE, LIMESTONE, SHALE SALT BEDS, SANDSTONE; CONGLOMERATE IN SOUTHEASTERN PART OF STATE. |
| DEVONIAN | (395-345 MILLION YEARS AGO) LOWER AND MIDDLE— LIMESTONE OVERLAIN BY SHALE, SILTSTONE AND SANDSTONE. |
| DEVONIAN | (395-345 MILLION YEARS AGO) EARLY UPPER - SHALE, SILTSTONE, SANDSTONE. |
| DEVONIAN | (395-345 MILLION YEARS AGO) LATE UPPER— SHALE, SILTSTONE, SANDSTONE. |

REFERENCE: GEOLOGY OF NEW YORK: A SHORT ACCOUNT. EDUCATIONAL LEAFLET NO. 20. THE UNIVERSITY OF THE STATE OF NEW YORK. [1]

Tonawanda Creek, New York

BEDROCK GEOLOGY MAP

Plate 2.3




ZONE 0 – NO DAMAGE

ZONE 1 – MINOR DAMAGE, DISTANT EARTHQUAKES MAY CAUSE DAMAGE TO STRUCTURES WITH FUNDAMENTAL PERIODS GREATER THAN 1.0 SECONDS; CORRESPONDS TO INTENSITIES V AND VI OF THE M.M.* SCALE

ZONE 2 – MODERATE DAMAGE, CORRESPONDS TO INTENSITY VII OF THE M.M.* SCALE

ZONE 3 – MAJOR DAMAGE, CORRESPONDS TO INTENSITY VIII AND HIGHER OF THE M.M.* SCALE

THIS MAP IS BASED ON THE KNOWN DISTRIBUTION OF DAMAGING EARTHQUAKES AND THE M.M.* INTENSITIES ASSOCIATED WITH THESE EARTHQUAKES; EVIDENCE OF STRAIN RELEASE; AND CONSIDERATION OF MAJOR GEOLOGIC STRUCTURES AND PROVINCES BELIEVED TO BE ASSOCIATED WITH EARTHQUAKE ACTIVITY.
THE PROBABLE FREQUENCY OF OCCURRENCE OF DAMAGING EARTHQUAKES IN EACH ZONE WAS NOT CONSIDERED IN ASSIGNING RATINGS TO THE VARIOUS ZONES.

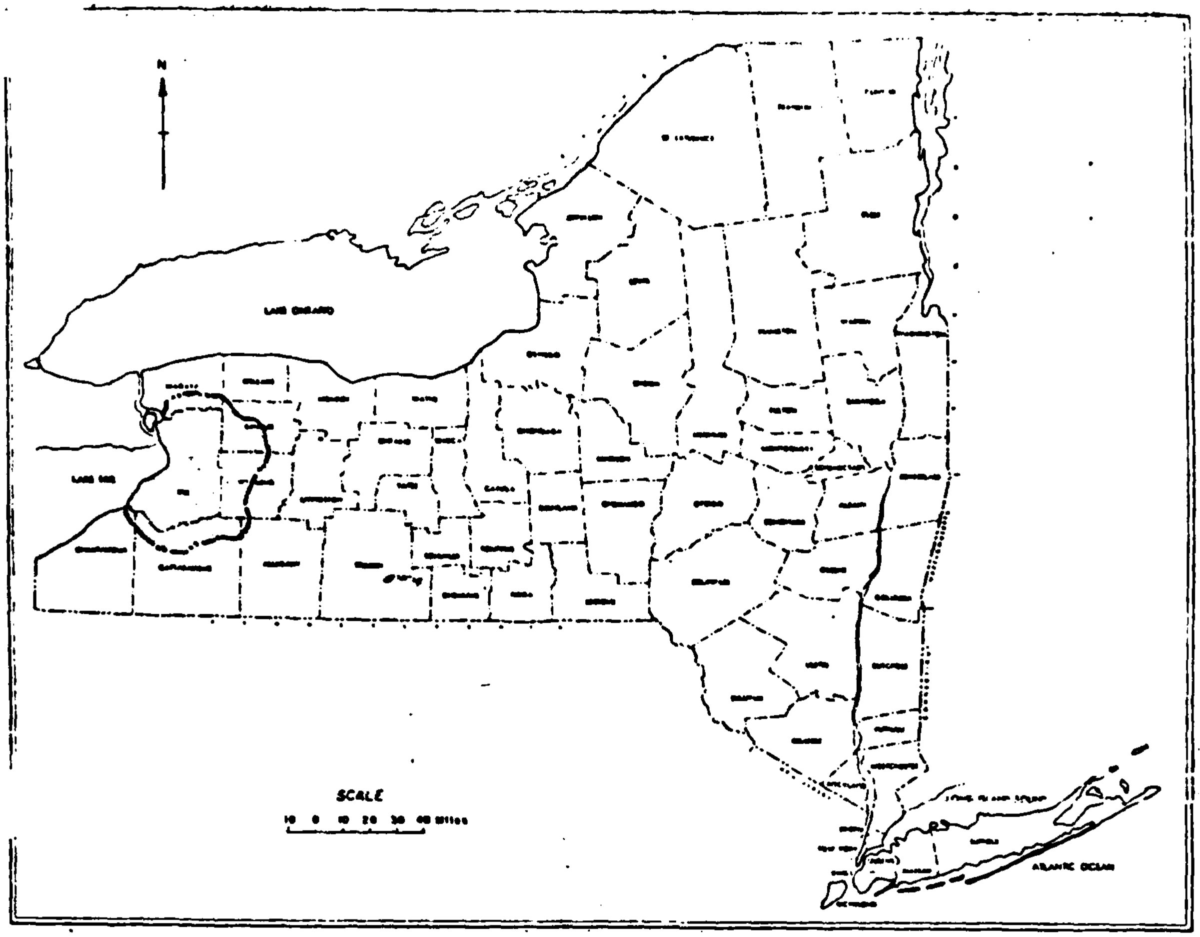
* MODIFIED MERCALLI INTENSITY SCALE OF 1931

(AFTER ALGERMISSEN 1969)

Tonawanda Creek, New York

SEISMIC RISK ZONES

Plate 2.4



Reference:
Erie - Niagara Basin Ground-Water Resources of the NYS Water Resources Comm.[3]

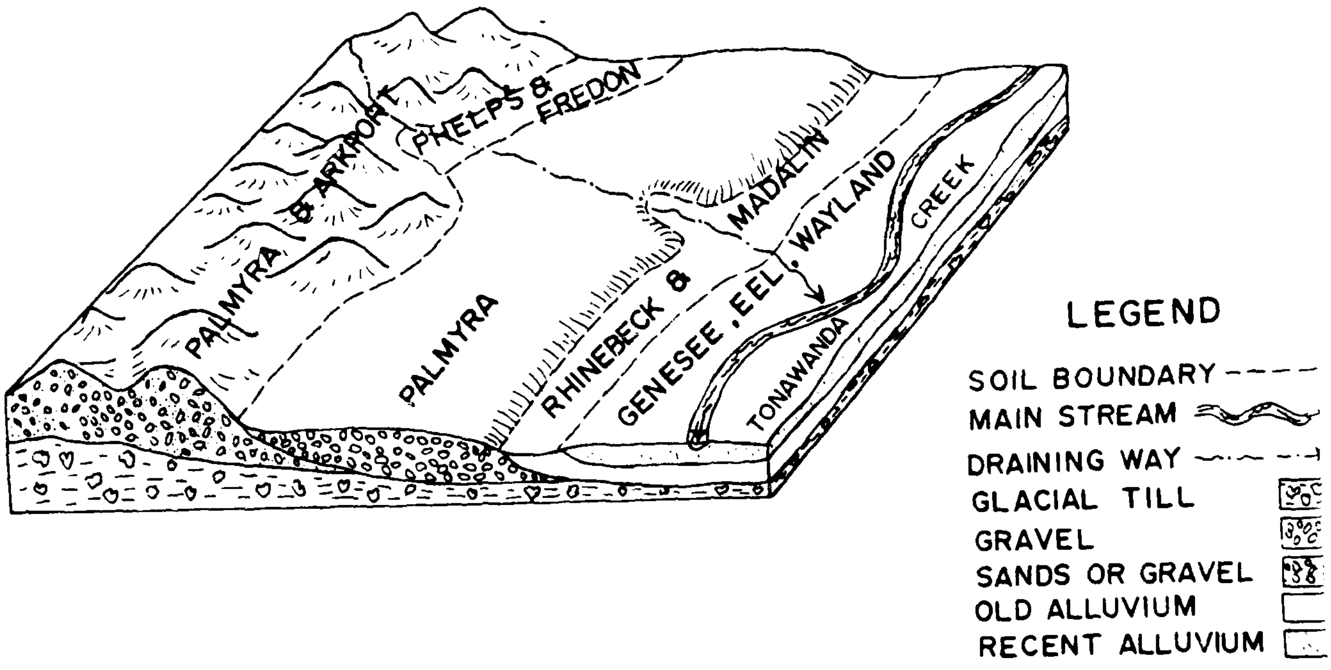
Tonawanda Creek, New York

ERIE - NIAGARA BASIN MAP

Plate 2.5

TERRESTRIAL SOILS

2.20 The soil maps shown on Plates 2.6A through 2.6E outline the patterns of soil types in the general vicinity of the proposed project each soil type is expressed by map symbol letters. The soil map and information on soil types found in this part of the environmental statement were obtained from a report on soils received from the U.S. Soil Conservation Service in Batavia, NY, entitled Soil Survey Genesee County, New York, which was issued in March 1969[5]. Table 2.A provides a general description of soil types in the Batavia Reservoir Compound site. The approximate area that may be temporarily inundated during major floods, if the project is implemented, is indicated by a heavy dark line on the maps. In general, soils in the area are deep and soil drainage varies according to soil type.




*Cross section showing typical soil pattern in the Palmyra association.*


Tonawanda Creek, New York

MAP OF SOIL TYPES IN VICINITY OF BATAVIA RESERVOIR COMPOUND

Plate 2.6A


Tonawanda Creek, New York

MAP OF SOIL TYPES IN VICINITY
OF BATAVIA RESERVOIR COMPOUND

**Plate 2.6B**


Tonawanda Creek, New York

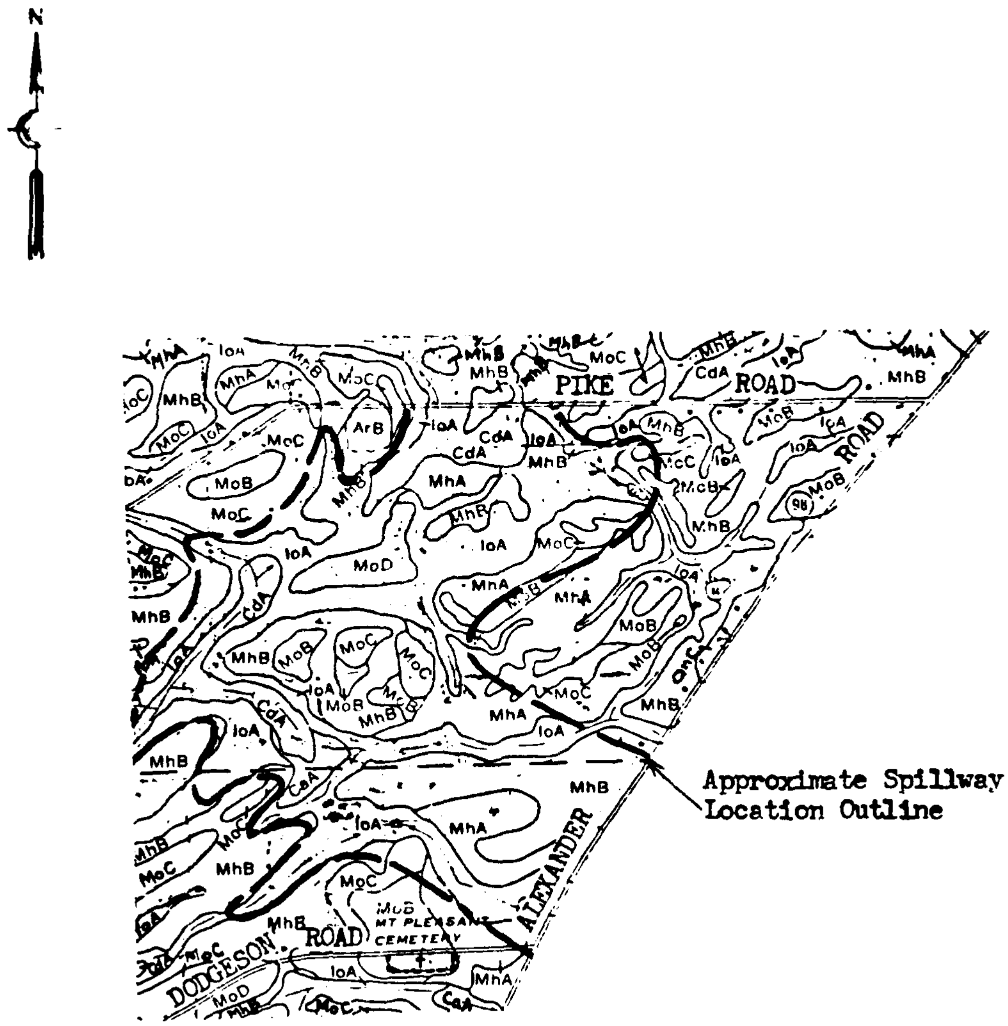
MAP OF SOIL TYPES IN VICINITY OF BATAVIA RESERVOIR COMPOUND

Plate 2.6C


Tonawanda Creek, New York

MAP OF SOIL TYPES IN VICINITY OF BATAVIA RESERVOIR COMPOUND

**Plate 2.6D**




Note: Same map scale as in
Plate 2.6A

Tonawanda Creek, New York

MAP OF SOIL TYPES IN
VICINITY OF BATAVIA
RESERVOIR COMPOUND SPILLWAY

Plate 2.6E

Table 2.A - Soil Description in Vicinity of Batavia Reservoir Compound Site

| Soil Map Symbol | Soil Name and Description(5) |
|---|---|
| ArB | Arkport very fine sandy loam, 1 to 6% slopes. This soil is on nearly level to gently convex slopes that receive no runoff from adjoining soils. It generally occurs on the top of dunelike ridges having smooth slopes, but the relief is gently undulating in a few places. Here, small inclusions of the moderately well drained Galen soils lie in depressional areas. Also included, in areas where the bands of finer textured material are less evident or missing in the subsoil, are small areas of Colonie soils. This soil is well suited to crops, pasture, or woodland. |
| AsD | Arkport and Dunkirk soils, 12 to 20% slopes. The soils in this undifferentiated group are on the moderately steep sides of sandy and silty lacustrine deposits. They occur mostly in the town of Pembroke. About 60 percent of the total acreage is Arkport very fine sandy loam, 35 percent is Dunkirk silt loam, and 5 percent is small areas of other soils included in mapping. Any given area may consist of the Arkport soil, the Dunkirk soil, or both soils in any proportion. Among the inclusions are small areas of Arkport or Dunkirk soil having slopes of less then 12 percent. On adjacent lower slopes are the gently sloping Galen or Collamer soils. The soils in this group can be used for crops, pasture, or woodland. |
| AsE | Arkport and Dunkirk soils, 20 to 40% slopes. These soils occupy the steep and very steep sides of sandy and silty lacustrine deposits. They occur mostly in the town of Pembroke and Batavia. Arkport soil makes up 60 percent of the total acreage; Dunkirk soil, 35 percent; and included areas of other soils, 5 percent. Any given area may consist of Arkport soil, of Dunkirk soil, or some of both. Among the included areas are ones having slopes of less than 20 percent. The soils in this group are too steep for row cropping. Some of the less steep areas can be used for pasture, but they are difficult to fertilize. The soils are well suited to trees. |
| ApB | Appleton silt loam, 3 to 8% slopes. This gently sloping soil occupies areas that receive runoff from adjacent slopes. Included with it, generally in depressions and drainageways, are small areas of poorly drained Lyons |

Table 2.A (Cont'd)

| Soil Map Symbol | Soil Name and Descriptions |
|---|---|
| | soils. Also included, on the crests of small undulations between drainageways, are small areas of moderately well drained Conesus or Hilton soils. Locally, somewhat poorly drained Kendaia soils occur as small inclusions. This soil can be used for crops, pasture, or woodland. |
| CaA | Canandaigua silt loam, 0 to 2% slopes. This nearly level, poorly drained soil occupies low areas that receive runoff from surrounding soils. Locally, small areas of the more sandy Lamson soils are included. This soil remains wet for a considerable time in spring. During April, the water table fluctuates between the surface and depth of 12 inches. In May, it falls to a depth of 20 inches between rains. Crops do well in fields where drainage is adequate, but outlets may be difficult to install. Undrained areas can be used for pasture except early in spring, when grazing is likely to damage the surface layer. |
| CdA | Canadaigua mucky silt loam, 0 to 2% slopes. This very poorly drained soil lies in depressional areas that are ponded until late in spring. The surface layer is mucky, especially in wooded areas, and in places the muck is as much as 12 inches thick. In cleared fields the surface layer generally contains less organic matter than in undisturbed areas. Included with this soil are small areas of the more sandy Lamson soils. Also included, in the lowest part of some depressions, are small spots of shallow muck. |
| ClB | Collamer silt loam, 2 to 6% slopes. This gently sloping soil is wet for short periods early in spring. It occupies undulating plains that rise slightly above the wetter landscape. It also occupies foot slopes of higher knolls. Included with this soil, in drainageways on the undulating plains, are small areas of somewhat poorly drained Niagara soils. These are commonly indicated by a wet-spot symbol on the soil map. Also included, where sandy bands are dominant in the profile, are small areas of Galen soils. This soil is suited to many kinds of crops. It can be used for truck crops, but it is better suited to field crops because it has higher reserve fertility and is more difficult to prepare as a seedbed than the more sandy soils that are used mainly for vegetables. |

Table 2.A (Cont'd)

| Soil Map Symbol | Soil Name and Descriptions |
|---|---|
| CmB | Colonie loamy fine sand, 2 to 6% slopes. This soil is on nearly level to gently convex slopes that receive no runoff from adjoining soils. It occurs on sandy dunes that rise distinctly above the surrounding landscape. Included with it, near the base of the dunes, are small areas of Elnora soils. Also included, in places where bands of finer textured material are more evident in the subsoil, are small areas of Arkport soils. This soil is suited to most crops and to pasture and woodland. |
| DaB | Darien silt loam, 3 to 8% slopes. This gently sloping or undulating soil occurs above steeper Darien soils and below gently sloping or moderately sloping, better drained soils, such as the Nunda or Conesus. In undulating areas its slopes are slightly convex, and small areas of poorly drained Ilion soils are included in drainageways or wet spots. Also included are small areas of clayey Remsen soils and of Burdett soils, which formed in a silty mantle. Row crops can be grown on this soil, but they do poorly in included wet areas and drainageways. |
| DuC | Dunkirk silt loam, 6 to 12% slopes. This moderately sloping soil occurs on the sides of silty dunes, and in places it occupies the sides and tops of smaller knolls. It has a thinner upper subsoil than the one typical for the series. Slopes are generally short. Small included spots are moderately eroded, and small areas of Arkport soils are included in places where bands of sandy material are dominant in the subsoil. This soil is suited to most crops. |
| Ee | Eel silt loam. This nearly level soil occurs on the flood plain of most streams. It lies adjacent to the well drained Genesee soils, which are on thicker alluvial deposits near the steams. Included with it, along the wetter drainageways, are small areas of Wayland soils. This soil is suited to crops, pasture, or woodland. It is used mainly for crops grown for dairy cattle. |
| Fo | Fonda mucky silt loam. This nearly level, very poorly drained soil lies in depressional areas that generally remain ponded until early in summer. It has a black surface layer that is considerably higher in organic matter content than the surface layer of the similar |

Table 2.A (Cont'd)

| Soil Map Symbol | Soil Name and Descriptions |
|---|---|
| | but poorly drained Madalin soils. In the deepest part of the depressional areas, there are spots of shallow muck. This soil is so wet and so difficult to drain that it is not suited to row crops. Some areas are flooded every spring and remain under water for a long time. Unelss their surface is drained, some areas are wet all year. In places the soil can be used for summer pasture. |
| [illegible]A | Galen and Minoa very fine sandy loams, 0 to 2% slopes. These nearly level soils were mapped together as an undifferentiated unit. Almost 60 percent of the total acreage is Galen very fine sandy loam, almost 40 percent is Minoa very fine sandy loam, and the rest is small areas of other soils included in mapping. Any given area may consist entirely of the moderately well drained Galen soil or the somewhat poorly drained Minoa soil. In most areas, however, the two soils occur together, and in these areas the Minoa is below the Galen and is adjacent to the poorly drained Lamson soils. Small inclusions of Collamer or Niagara soils were mapped in places where silty bands are dominant in the subsoil. Also included are small areas of wetter or drier soils. If the soils in this unit are drained, they are suited to many kinds or crops. They are excellent soils for truck crops because in dry periods they hold more available moisture than more sloping sandy soils. |
| GnB | Galen very fine sandy loam, 2 to 6 percent slopes. This gently sloping soil is wet for short periods early in spring. It occupies undulating sandy plains that rise slightly above the surrounding landscape, and it also occurs on foot slopes of higher sandy knolls. Small included areas occupy high spots on the undulating plains. Also included, in places where silty bands are dominant are inclusions of somewhat poorly drained Minoa soils that lie in drainageways and commonly are shown by symbol on the soil map. Many kinds of crops are suited to this soil. They respond well to good management, but in dry weather they show signs of moisture deficiency sooner on this soil than on the nearly level Galen soil. |
| Gs | Genesee silt loam. This nearly level, well-drained soil lies on flood plains, generally next to the main stream. Included with it are small spots of the wetter Eel silt loam. Genesee silt loam is well suited to most crops. Normally, it is more productive than well-drained soils on nearby terraces and uplands. |

Table 2.A (Cont'd)

| Soil Map Symbol | Soil Name and Descriptions |
|---|---|
| HaA | <u>Halsey silt loam, 0 to 4% slopes</u>. This soil occurs in low areas that remain wet for a long period in spring. Contributing to this wetness is surface runoff or seepage from higher areas. Sandy spots of Lamson soil are the most common inclusions. Undrained areas of this Halsey soil can be used for forage crops or as woodland. If drained, the soil is suited to many kinds of row crops and can be used intensively. |
| H1B | <u>Hilton loam, 3 to 8% slopes</u>. This gently sloping, moderately well drained soil receives seepage from higher soils. Areas in the northeastern part of the county have large stones or boulders in the subsoil and crests of undulations, where the leached upper subsoil is thin or has been mixed. |
| loA | <u>Ilion silt loam, 0 to 3% slopes</u>. This poorly drained soil occurs in low, flat or depressional areas that receive runoff from higher areas of Darien, Burdett, Remsen, or Manheim soils. In some areas it is covered by as much as one foot of material that washed from surrounding soils. In places where it occurs near the Manheim soils, it has a more shaly substratum than typical Ilion soils. Included with this soil, in the deeper depression, are small areas of very poorly drained Alden or Fonda soils. |
| Ld | <u>Lamson very fine sandy loam</u>. This poorly drained, level or nearly level soil lies in low areas that receive runoff from higher soils. Locally, small areas of the more silty Canadaigua soils are included. The soil remains wet for long periods in spring. During April the water table fluctuates between the surface and a depth of 12 inches. In May, it may fall to a 20-inch depth between rains. Crops respond well in fields that are adequately drained. Undrained areas of this soil are suitable for pasture. |
| Le | <u>Lamson mucky very fine sandy loam</u>. This very poorly drained soil occurs in depressional areas that are ponded until late in spring. In fields that have been cleared and cultivated, the surface layer contains less organic matter than in other areas. This soil lies adjacent to poorly drained Lamson very fine sandy loam, a soil that is |

Table 2.A (Cont'd)

| Soil Map Symbol | Soil Name and Descriptions |
|---|---|
| | included with this one in small areas. Also included, in the lowest part of some depressions, are small spots of shallow muck. |
| LmB | Lima silt loam, 3 to 8% slopes. Although this soil is gently sloping, it is slowly permeable and therefore is wet for short periods in spring. It contains free lime at a lesser depth than the nearly level Lima soils. Small inclusions of somewhat poorly drained Kendaia soils lie in drainageways that thread between low knolls or rises, and small inclusions of well-drained Honeoye soils commonly cap the knolls. Each of these included soils occupies about 10 percent of the total acreage. Also included, just south of the village of Stafford, are small areas of darker Mohawk soils. This Lima soil is well suited to crops, pasture, and woodland. |
| Ma | Madalin silty clay loam. This level or nearly level, poorly drained soil lies in areas where surface water is removed very slowly. It is adjacent to slightly higher areas of nearly level, somewhat poorly drained Rhinebeck soil. Included with this Madalin soil are small, poorly drained areas in which the substratum consists of shaly silty clay. Also included, in depressional areas, are small areas of Fonda soils. This soil is too wet for row crops. It is flooded every spring, and floodwater leaves the surface very slowly after the stream recedes. |
| MhA | Manheim silt loam, 0 to 3% slopes. This nearly level soil occurs in areas that are underlain chiefly by hard, dark-colored, high-lime shale. The layer underlying the surface layer commonly is thicker than the one described for the series. Drainage is somewhat poor in most places, but it is moderately good in a few areas. The soil adjoins areas of poorly drained Ilion or Lyons soils. Included are spots of the more clayey Darien soils. Although row crops can be grown in undrained fields, they do better if drainage is improved. |
| MhB | Manheim silt loam, 3 to 8% slopes. This gently sloping soil is in areas underlain mainly by dark, hard, high-lime shale. About half the acreage is moderately well drained, and half is somewhat poorly drained. Included with this soil,on the crests of low knolls, are small |

Table 2.A (Cont'd)

| Soil Map Symbol | Soil Name and Descriptions |
|---|---|
| | areas of moderately well drained Mohawk soils. Also included are small areas of the more clayey Darien soils, and pockets of the poorly drained Ilion soils. This soil is suited to cultivated crops, pasture, or woodland. It is productive under good management, though it is highly erodible. |
| MoB | Mohawk silt loam, 2 to 8 percent slopes. This nearly level and gently sloping soil occupies areas that receive no runoff from adjacent soils. Locally, spots of more clayey Darien soils are included. Most crops can be grown on this soil. Natural fertility is high, and little lime is needed for crops. |
| MoC | Mohawk silt loam, 8 to 15% slopes. This deep soil is moderately sloping, but the slopes tend to be short and choppy. Included with it are small areas that are only moderately deep to shale bedrock. Most crops are suited to this soil. Because conservation measures are difficult to establish, however, intertilled crops should be grown in a suitable rotation. Reserve fertility is high. |
| Mr | Muck, deep. Muck, deep consists of areas in which muck is at least 42 inches thick over marl or other mineral soil material. The muck is made up of the decayed remains of fibrous and woody plants. It is black and well decomposed in the upper part but is very dark brown and only partially decomposed below a depth of 20 inches. Fragments of trees are common below a 2-foot depth. The muck generally ranges from 4 to 10 feet in thickness, though in places it is as much as 20 feet thick. It ranges from strongly acid to neutral but generally is acid to some degree. Most of the underlying materal is lacustrine in origin and consists of well-sorted sand, silt, or clay. Varved deposits of differing mineral material are common. In other areas the muck is underlain by stony till, and in a few areas it is underlain by marl. |
| Ms | Muck, shallow. Muck, shallow consists of areas where muck is underlain by mineral material at a depth of 12 to 42 inches. The muck is in a black, very strongly acid to slightly acid layer made up of the decayed remains of woody plants. In most places the underlying material is lacustrine in origin and consists of well-sorted sand, silt, or clay. Commonly, however, it is varved deposits of differing soil material. Some areas are underlain by stony till. |

Table 2.A (Cont'd)

| Soil Map Symbol | Soil Name and Descriptions |
|---|---|
| NaA | Niagara and Collamer silt loams, 0 to 2% slopes. The nearly level soils in this undifferentiated unit generally occur in such an intricate pattern that mapping the soils separately was impractical. Nearly 55 percent of the total acreage is the somewhat poorly drained Niagara soil or a closely associated soil having similar drainage. Nearly 45 percent, is the moderately well drained Collamer soil or a closely asociated soil having similar drainage. Included areas of other soils account for the small remaining acreage. Any given area mapped as this unit may consist only of the Niagara soil or the Collamer soil. In most areas, however, the two soils occur together, the Niagara in the lower part and the Collamer in the slightly higher part. Both soils receive some runoff from adjacent slopes, though the Niagara gets the larger share. Small inclusions of the Minoa soils or the Galen soils were mapped in places where sandy bands are dominant in the subsoil. Also included in mapping were small areas of better drained or more poorly drained soils. After drainage is improved, the soils in this unit are suited to many kinds of crops. Truck crops do well, but seedbeds are slightly more difficult to prepare than on the more sandy soils. Legumes and grasses generally grow better than on the sandy soils, as reserve fertility in these loamy soils is higher. |
| OdA | Odessa silt loam, 0 to 2% slopes. This nearly level, high-lime soil is in areas that receive runoff from higher soils. Small inclusions of Lakemont soils lie in depressional areas. These inclusions occur as wet spots, which generally are shown by symbol on the soil map. Also included are small areas of Ovid soils in places where the soil material normally is clayey but contains erratic spots of glacial till. Unless artificial drainage is provided, row crops cannot be successfully grown on this soil, but water-tolerant grasses and legumes do fairly well. |
| OdB | Odessa silt loam, 2 to 6% slopes. This gently sloping, high lime soil occupies areas that receive runoff from adjacent soils. In some places it lacks the light-colored upper part of the subsoil that is typical for the series. Included with this soil, on the crests of low knolls in undulating areas, are small areas of Schoharie soils. Also incldued, in places having erratic spots of glacial till mixed with the clayey soil material, are small |

Table 2.A (Cont'd)

| Soil Map Symbol | Soil Name and Descriptions |
|---|---|
| | areas of Schoharie soils. Also included, in places having erratic spots of glacial till mixed with the clayey soil material, are small areas of Ovid soils. Row crops can be produced on this soil, but their growth commonly is spotty because plants in the many troughs and drainageways are injured or drowned by excess water. |
| OnB | <u>Ontario loam, 3 to 8% slopes</u>. This gently sloping soil generally occurs in convex areas above steeper Ontario soils. It also lies in positions above gently sloping Hilton or Lima soils and below nearly level Ontario soils. In these positions, however, it receives little runoff from higher slopes. Included with this soil are small areas of Cazenovia soils. All crops commonly grown in the county are well suited to this soil. Many areas are used intensively for intertilled crops. Pasture plants and trees trees also do well. Loss of water through runoff and a slight erosion hazard, especially on longer slopes, are the chief concerns of management. |
| OnC | <u>Ontario loam, 8 to 15% slopes</u>. This moderately sloping soil is commonly found on elongated ridges or on the side of ridges. It is similar to typical Ontario soils in most respects, but its leached subsurface layer is thinner. Small included spots are moderately eroded, and in these places some of the subsurface layer has been mixed into the plow layer during tillage. Also included are small areas of gravelly Palmyra soils. This soil is suited to crops, pasture, or woodland, though much of the rain that falls on it is lost as runoff. |
| PaB | <u>Palmyra gravelly loam, 3 to 8% slopes</u>. This gently sloping soil is mainly found on outwash terraces, but it also occupies small terrace dunes scattered in larger areas of glacial till. In the southern part of the county, it occurs on small alluvial fans where side streams enter the main valleys. Most slopes are undulating. Small inclusions of moderately well drained Phelps soils occur in terrace depressions and along the edge of terraces. Also included are small wet spots; these are shown on the soil map by a wet-spot symbol or as an intermittent stream. This soil is among the most desirable in the county for all crops commonly grown. |

Table 2.A (Cont'd)

| Soil Map Symbol | Soil Name and Descriptions |
|---|---|
| PaC | Palmyra gravelly loam, 8 to 15% slopes. This moderately sloping soil is thinner in the upper subsoil than the typical one described for the series. Slopes are commonly irregular in rolling areas on kames, but they are generally uniform along the edges of outwash terrraces. Small included areas are moderately eroded; these occur mainly on prominent crests or on terrace shoulders. Also included are spots of Palmyra fine sandy loam and small areas of Arkport soils. This soil is suited to crops, pasture, or woodland. Deep-rooted crops ordinarily do better than others, for water is lost through runoff and the moisture holding capacity is limited. |
| PkD | Palmyra and Arkport soils, 15 to 25% slopes. These moderately steep, well-drained soils are medium textured or moderately coarse textured. They generally occur in hilly areas that slope in more than one direction, but they also occupy the faces of outwash terraces or the steeper sides of sandy lacustrine deposits. A given area mapped as this unit may consist of Palmyra soils, Arkport soils, or some of both kinds. These soils are eroded in some places, mainly on prominent crests where calcereous sand or gravel is within 10 inches of the surface. Generally, the material washed from these places accumulates at the foot of hills or between them. The supply of available moisture therefore varies widely from hilltops to adjacent depressions. Included with these soils are small areas of Chenango or Dunkirk soils. Although the soils of this unit can be cropped, they are more suitable for pasture or woodland. |
| PkE | Palmyra and Arkport soils, 25 to 40% slopes. The soils in this unit are most extensive along the east side of the Tonawanda Creek valley north of Attica, in an area between Attica and Darien, and in a band extending roughly east and west across the central part of the county. These steep and very steep soils commonly occur together in places where glaciers deposited material erratically in kames. On terrace faces, however, the Palmyra soils may occupy nearly all of a given area mapped as this unit, and on the sides of lacustrine deposits, the Arkport soils may account for nearly all the acreage of a mapped area. Some areas are cleared of trees and are moderately eroded. Small inclusions of Dunkirk soils occur with the Arkport soils on lacustrine deposits. Also included are small areas of Chenango soils. The soils in this unit are too steep for cultivation. Although some areas can be used for pasture, woodland generally is a better use. |

Table 2.A (Cont'd)

| Soil Map Symbol | Soil Name and Descriptions |
|---|---|
| PlB | Palmyra shaly silt load, 3 to 8% slopes. This gently sloping soil occurs mostly on terrace deposits between Batavia and Darien. It formed in glacial outwash containing more calcareous shale and less limestone than the the parent material of typical Palmyra soils. As a result, this soil has a darker profile than those soils, and it contains less sand and more silt and clay throughout the surface layer and subsoil. Most slopes are undulating. Included are small areas of moderately well drained Phelps soils in depressions and along the edges of terraces. Also included are small wet areas, some of which are shown on the soil map as wet spots or as intermittent streams. Almost all crops can be grown on this soil, but erosion control measures are needed for maintaining good tilth. The moisture and nutrient supplying capacity is good to excellent. |
| PrA | Phelps and Fredon gravelly loams, 0 to 3% slopes. This undifferentiated unit is made up of Phelps gravelly loam, Fredon gravelly loam, or both. In an area where both soils occur, the moderately well drained Phelps soil is on a slight rise along the edge of the area, adjacent to the better drained Palmyra soils, and the somewhat poorly drained Fredon soil is in low, nearly flat or slightly concave positions between the rises. Wetness early in spring delays the planting of row crops, but the extent of delay depends on the amount of Fredon soil in a given area. If drainage is improved where needed, the soils are excellent for farming. |
| PsB | Phelps gravelly loam, 3 to 8% slopes. This gently sloping or undulating, moderately well drained soil is underlain by sand and gravel. Small included areas of Fredon soils lie in drainageways, and small inclusions of well-drained Palmyra soils are on the top of knolls or in higher areas adjacent to this soil. This soil is suited to crops, pasture, or woodland. |
| ReA | Remsen silt loam, 0 to 3% slopes. This nearly level soil occupies areas that receive runoff from gently sloping Remsen, Darien, or Munda soils. It is thicker in the surface layer and upper subsoil than other soils of the series, and in most places it is a little more poorly drained than other Remsen soils. Small inclusions of the poorly drained Madalin soils lie in lower adjacent areas or in wet spots. The wet spots are indicated by symbol on the |

Table 2.A (Cont'd)

| Soil Map Symbol | Soil Name and Descriptions |
|---|---|
| | soil map. Also included are small low-lying areas of poorly drained Ilion soils; small areas of moderately fine textured Darien soils; and, in places having a silty mantle, small areas of Burdett soils. Row crops are difficult to grow on this soil unless drainage is improved. Some kinds of row crops show adverse effects of excess water after a heavy summer rain. The soil is suited to forage crops used in dairying. Water-tolerant grasses and legumes do fairly well. |
| ReB | Remsen silt loam, 3 to 8% slopes. This soil is gently sloping or undulating. In gently sloping areas, it commonly lies above more sloping Remsen soils in the more dissected parts of the plateau. Where the soil is undulating, it occupies nearly all of each area mapped except the drainageways, which contain small inclusions of poorly drained Madalin soils. Also included are small areas of somewhat poorly drained Burdett or Darien soils. This is fair to good soil for crops if it is drained and properly fertilized. Suitable legumes grow well, and so do other forage crops grown for dairy cattle. |
| ReC | Remsen silt loam, 8 to 15% slopes. This moderately sloping soil is underlain by fine-textured, shaly till. It lies on the crests of ridges and on the side slopes of the dissected plateau. Areas mapped on the plateau are below areas of less sloping Remsen soils. This soil has a thinner sub-surface layer than that in a typical Remsen soil. Small areas of Darien or Nunda soils are included. Suitable row crops can be grown on this soil, but erosion is a severe hazard. Excess water is of less concern than on less sloping Remsen soils, though drainage is somewhat poor. |
| RmC3 | Remsen silty clay loam, 8 to 15% slopes, eroded. This moderately steep soil occurs in areas of fine-textured, shaly glacial till. It lies on the crests of ridges and on the side slopes of the dissected plateau. The original surface layer has been washed away, and the plow layer contains material from the clayey subsoil that makes it finer textured and less friable than the surface layer of uneroded Remsen soils. Also, the capacity to hold available moisture is considerably lower in this soil than it is in those soils. Row crops do poorly on this soil. Their seeds germinate at a low and uneven rate. Sod crops, especially suitable legumes, should be grown. |

Table 2.A (Cont'd)

| Soil Map Symbol | Soil Name and Descriptions |
|---|---|
| RmD3 | Remsen silty clay loam, 15 to 25% slopes, eroded. This moderately steep soil occurs in areas of fine-textured, shaly glacial till on the dissected plateau. It is generally somewhat poorly drained but in some places is moderately well drained. In most of the cleared areas, the original surface lever has been removed through erosion, and material brought up from the clayey subsoil makes the plow layer finer textured and less friable than the surface layer of uneroded Remsen soils. The available moisture capacity is very low in this soil. Small included areas are wooded; in these the surface layer, subsoil, and substratum are similar to those described for the series, though the surface layer and subsoil are somewhat thinner than they are in most places. Row crops do very poorly on this soil, and only poor to fair growth is obtained from suitable legumes used for long-term hay or pasture. |
| Ro | Rhinebeck silt loam. This soil is nearly level, stone free, and somewhat poorly drained. Most of it occupies broad areas in the basins of Tonawanda and Oak Orchard Creeks. A smaller acreage is in other valleys. The soil commonly lies next to the main stream, where it adjoins the Genesee or Eel soil and is slightly below the Madalin soil, which generally occurs some distance from the stream. Common inclusions are small, higher areas of somewhat similar but moderately well drained soils. This soil can be used for row crops if it is drained. |
| Sn | Sloan silt loam. This very poorly drained soil lies in the valleys of streams. In narrow valleys it adjoins the stream, but in the wider valleys it occupies low areas away from the stream. Commonly, it is in oxbow channels that have been partly filled with soil material. In some places it is underlain by gravel at a depth of 3 to 5 feet. Where the soil has been cleared, the profile is similar to that of the Wayland soils, which lie closer to the stream, but in wooded areas the surface layer is covered with black muck, which is lacking in the Wayland soils. Small areas of these soils are included. Generally, the only uses for this soil on farms are limited pasture in summer and habitat for some kinds of wildlife. Because the soil normally occupies such low positions, it is difficult to drain. The only trees that will grow are adapted wetland species. |

Table 2.A (Cont'd)

| Soil Map Symbol | Soil Name and Descriptions |
|---|---|
| Wa | Wayland silt loam.<br>This nearly level soil occupies low areas on flood plains, where it is flooded every spring. Included with it, on adjacent thicker and slightly more elevated alluvial deposits, are small areas of moderately well drained Eel soils. Also included, in old oxbow drainageways, are small areas of very poorly drained Sloan soils. In undrained areas pasture is a good use for this soil. Row crops cannot be successfully grown unless drainage is improved, but suitable outlets for tile drains may be difficult to establish. Flooding is a hazard during heavy thundershowers in midsummer. |

## CLIMATOLOGY

2.21 General - The type, location and period of record for seven precipitation stations and one first order weather station located in the general vicinity of the Tonawanda Creek Watershed are shown in Table 2B. The first order weather station is at the Greater Buffalo International Airport, located about 30 miles southwest of the city of Batavia.

Table 2.B - Climatological Stations in the General Vicinity of the Tonawanda Creek Watershed

| Station-Name | Index No. | County | Latitude | Longitude | Elevation | Record* | Record of Years |
|---|---|---|---|---|---|---|---|
| Arcade | 0220 | Wyoming | 42°32' | 78°25' | 1480 | NR,S,T,P | 46 |
| Batavia | 0443 | Genesee | 43°00' | 78°11' | 900 | NR,S,T,P | 38 |
| Buffalo WB Airport | 1012 | Erie | 42°56' | 78°44' | 705 | N,S,T,P,J | 112 |
| Linden | 4767 | Genesee | 42°53' | 78°10' | 1120 | NR,S,P | 56** |
| Lockport 2NE | 4844 | Niagara | 43°11' | 78°39' | 520 | NR,S,T,P | 83 |
| Stafford | 8152 | Genesee | 42°59' | 78°05' | 915 | NR,S,T,P | 37** |
| Wales | 8910 | Erie | 42°45' | 78°31' | 1090 | R,P | 21 |
| Warsaw 5 SW | 8962 | Wyoming | 42°41' | 78°12' | 1715 | NR,S,T,P | 17 |

* Type of record code:
R-recording gage
NR-non-recording gage
S-snowfall and snow on ground
T-temperature
P-precipitation
J-supplemental data

** Station discontinued in 1968

2.22 Precipitation - The average annual precipitation for the eight stations listed is 35.36 inches. Table 2.C shows monthly and yearly average precipitation for each of the stations and the combined averages for these stations. The monthly averages vary from a minimum of 2.50 inches in February to a maximum of 3.26 inches in August. The lowest average monthly precipitation, 2.19 inches, is found at Batavia in January, whereas the highest average monthly precipitation, 4.25 inches, is found at Warsaw in August. Average annual precipitation varies from 31.27 inches at Stafford to 40.93 inches at Arcade.

Table 2.C - Average Monthly Precipitation in Inches

| Station | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sep. | Oct. | Nov. | Dec. | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Arcade | 3.17 | 2.61 | 3.01 | 3.19 | 4.01 | 4.17 | 3.91 | 3.64 | 3.66 | 3.36 | 3.10 | 3.10 | 40.93 |
| Batavia | 2.19 | 2.25 | 2.60 | 2.99 | 3.10 | 2.77 | 2.89 | 3.08 | 2.72 | 2.60 | 2.58 | 2.26 | 32.03 |
| Bflo. WB Airport | 3.11 | 2.83 | 2.84 | 2.62 | 2.93 | 2.78 | 2.89 | 2.94 | 3.09 | 3.18 | 3.14 | 3.20 | 35.55 |
| Linden | 2.37 | 2.30 | 2.61 | 3.01 | 3.07 | 3.46 | 3.25 | 3.28 | 3.06 | 3.19 | 2.92 | 2.31 | 34.83 |
| Lockport 2 NE | 2.39 | 2.44 | 2.49 | 2.78 | 3.11 | 2.46 | 2.65 | 3.04 | 2.87 | 2.73 | 2.68 | 2.41 | 32.05 |
| Stafford | 2.21 | 2.24 | 2.42 | 2.89 | 3.02 | 2.69 | 2.84 | 2.94 | 2.81 | 2.65 | 2.48 | 2.08 | 31.27 |
| Wales | 2.92 | 2.51 | 3.36 | 3.39 | 3.09 | 2.64 | 3.24 | 2.94 | 3.04 | 3.11 | 3.05 | 3.19 | 36.48 |
| Warsaw 5 SW | 2.92 | 2.81 | 3.43 | 4.00 | 3.20 | 3.46 | 3.19 | 4.25 | 3.05 | 3.55 | 2.99 | 2.84 | 39.69 |
| Average | 2.66 | 2.50 | 2.85 | 3.11 | 3.19 | 3.05 | 3.11 | 3.26 | 3.04 | 3.05 | 2.87 | 2.67 | 35.36 |

Years of record to 1967

2.23 <u>Snowfall</u> - The average annual snowfall for the eight stations in Table 2.D is 80.6 inches; for the first order weather station, the average annual snowfall is 78.4 inches.

Table 2.D - Average Monthly Snowfall in Inches

| Station | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sep. | Oct. | Nov. | Dec. | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Arcade | 22.4 | 17.5 | 15.2 | 4.1 | 0.3 | T | 0 | 0 | T | 1.3 | 11.8 | 19.6 | 92.2 |
| Batavia | 20.1 | 21.5 | 16.0 | 4.2 | 0.3 | 0 | 0 | 0 | T | 0.3 | 11.3 | 17.9 | 91.6 |
| B[illegible] WB Airport | 19.6 | 17.6 | 11.5 | 3.2 | 0.2 | 0 | 0 | 0 | T | 0.4 | 7.9 | 18.0 | 78.4 |
| Linden | 19.7 | 19.2 | 13.1 | 2.9 | 0 | 0 | 0 | 0 | 0 | T | 10.4 | 14.8 | 80.0 |
| Lockport 2 NE | 12.5 | 13.3 | 9.8 | 2.1 | T | 0 | 0 | T | T | 0.1 | 5.7 | 10.4 | 53.9 |
| Stafford | 16.1 | 18.1 | 15.1 | 3.0 | T | 0 | 0 | 0 | 0 | 2.0 | 8.9 | 13.6 | 75.0 |
| Warsaw 5 SW | 18.5 | 17.3 | 19.6 | 7.0 | 0.3 | 0 | 0 | 0 | 0 | 0.5 | 12.5 | 17.2 | 92.9 |
| Average | 18.4 | 17.7 | 14.3 | 3.7 | 0.2 | T | 0 | T | T | 0.7 | 9.7 | 15.9 | 80.6 |

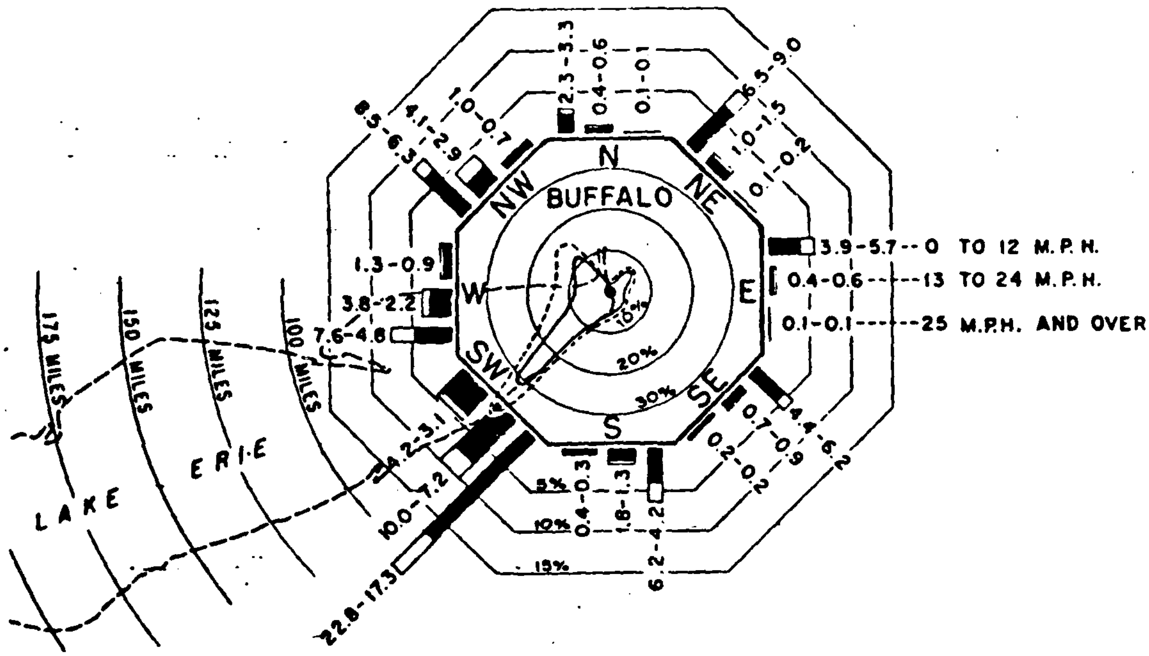
T - Trace

2.24 Temperature - The average annual temperature for the six stations recording temperature is 46.6 degrees Fahrenheit. July is the warmest month and January the coldest, with average monthly temperatures of 69.2 and 23.3 degrees Fahrenheit, respectively. Table 2.E shows the average monthly temperatures.

Table 2.E - Average Monthly Temperature in Degrees Fahrenheit

| Station | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sep. | Oct. | Nov. | Dec. | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Arcade | 21.2 | 24.6 | 30.0 | 44.5 | 54.8 | 63.4 | 67.1 | 66.1 | 59.4 | 49.2 | 38.1 | 25.6 | 45.3 |
| Batavia | 23.9 | 25.2 | 32.6 | 44.9 | 55.4 | 65.5 | 69.2 | 68.1 | 61.2 | 51.4 | 39.2 | 27.3 | 47.0 |
| Bflo. WB Airport | 25.0 | 24.7 | 32.0 | 43.0 | 54.3 | 64.8 | 70.1 | 68.5 | 62.3 | 51.1 | 39.4 | 29.2 | 47.1 |
| Lockport 2 NE | 25.3 | 25.3 | 32.7 | 44.8 | 56.1 | 66.2 | 71.1 | 69.6 | 62.4 | 52.0 | 40.0 | 28.8 | 47.9 |
| Stafford | 24.7 | 24.7 | 32.6 | 45.4 | 57.0 | 66.9 | 71.3 | 69.4 | 62.4 | 52.0 | 39.7 | 28.3 | 47.9 |
| Warsaw 5 S! | 19.9 | 22.9 | 28.1 | 44.3 | 44.3 | 63.0 | 66.6 | 65.7 | 59.3 | 49.6 | 37.1 | 24.6 | 44.6 |
| Average | 23.3 | 24.6 | 31.3 | 44.5 | 55.3 | 65.0 | 69.2 | 67.9 | 61.2 | 50.9 | 38.9 | 27.3 | 46.6 |

2.25 Wind - Wind data for the general vicinities of Buffalo, NY, and Rochester, NY, based on records of the two closest U. S. Coast Guard stations are given in Plates 2.7 and 2.8. The Coast Guard Station at Buffalo is located approximately 30 miles southwest of the city of Batavia, NY, and the Coast Guard Station at Rochester is located about 35 miles northeast of the city of Batavia, NY.




## NOTES

INDICATES DURATION FOR ICE-FREE PERIOD (MAR. TO DEC. INCL.) IN PERCENT OF TOTAL DURATION.

INDICATES DURATION FOR ICE PERIOD (JAN. TO FEB. INCL.) IN PERCENT OF TOTAL DURATION.

INDICATES PERCENT OF TOTAL WIND MOVEMENT OCCURRING DURING ICE-FREE PERIOD.

INDICATES PERCENT OF TOTAL WIND MOVEMENT OCCURRING DURING COMBINED ICE AND ICE-FREE PERIODS.

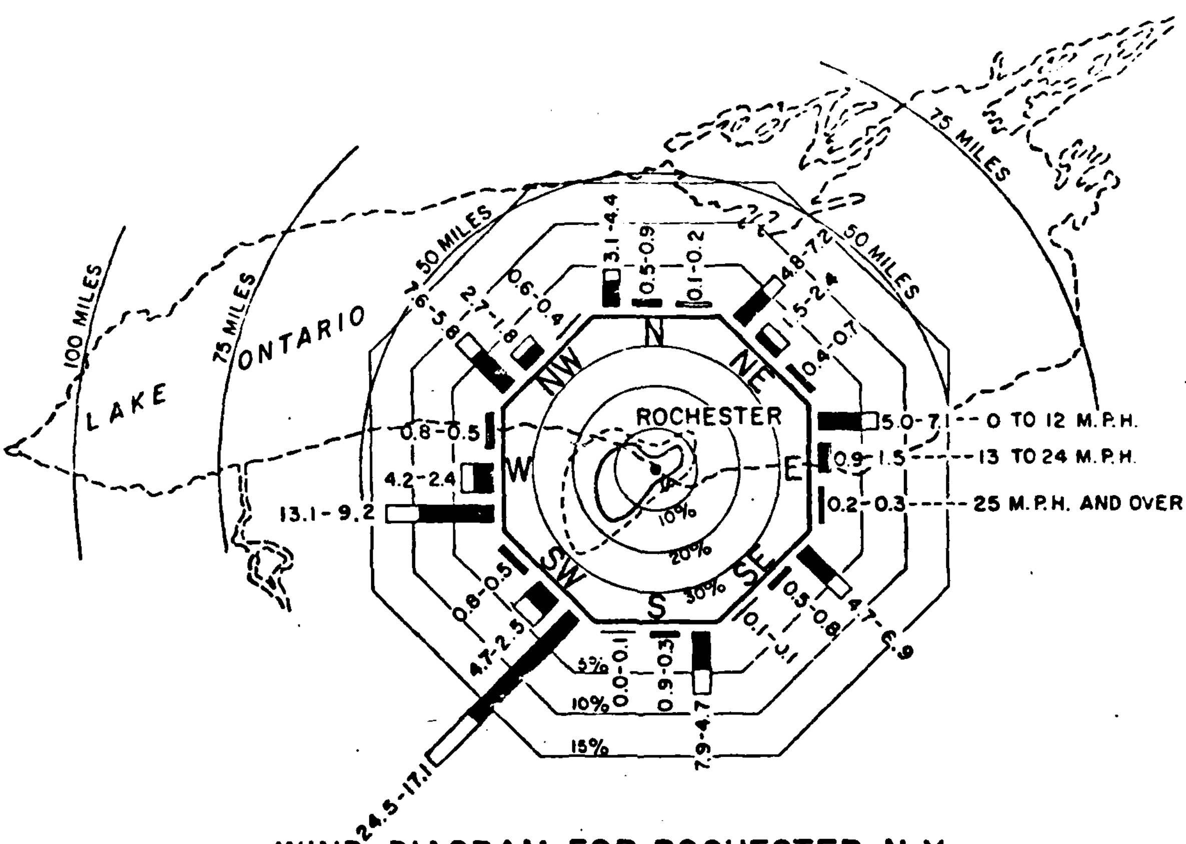
FIGURES AT ENDS OF BARS INDICATE PERCENT OF TOTAL WIND DURATION FOR ICE-FREE PERIOD AND COMBINED ICE-FREE AND ICE PERIODS, RESPECTIVELY.

WIND DATA BASED ON RECORDS OF THE U.S. COAST GUARD AT BUFFALO, N. Y. FOR PERIOD 1 JAN. 1936 TO 31 DEC. 1943 AND 1 JAN. 1947 TO 31 DEC. 1971

Tonawanda Creek, New York

WIND DIAGRAM
FOR BUFFALO VICINITY

Plate 2.7




## WIND DIAGRAM FOR ROCHESTER, N.Y.

### NOTES

INDICATES DURATION FOR ICE-FREE PERIOD (MAR. TO DEC. INCL.) IN PERCENT OF TOTAL DURATION.

INDICATES DURATION FOR ICE PERIOD (JAN. TO FEB. INCL.) IN PERCENT OF TOTAL DURATION.

INDICATES PERCENT OF TOTAL WIND MOVEMENT OCCURRING DURING ICE-FREE PERIOD.

INDICATES PERCENT OF TOTAL WIND MOVEMENT OCCURRING DURING COMBINED ICE AND ICE-FREE PERIODS.

FIGURES AT ENDS OF BARS INDICATE PERCENT OF TOTAL WIND DURATION FOR ICE-FREE PERIOD AND COMBINED ICE FREE AND ICE PERIODS, RESPECTIVELY.

WIND DATA BASED ON RECORDS OF THE U.S. COAST GUARD AT ROCHESTER, N.Y. FOR PERIOD 1 JAN. 1947 TO 31 DEC. 1971 INCLUSIVE.

Tonawanda Creek, New York

WIND DIAGRAM
FOR ROCHESTER VICINITY

Plate 2.8

2.26 Air Quality - The Air Pollution Control Division of the Erie County Department of Health maintains four continuous air monitoring stations (CAM's) and 22 manual sampling air quality stations in Erie County[2]. CAM's measure particulates, sulfur dioxide, nitrogen oxides, ozone, carbon monoxide and weather. CAM's are run continuously and are connected to a centralized data processor. Manual sampling is done periodically for suspended particulates, settleable particles and sulfation rate. Data on these parameters recorded for 1970-1974 pertinent to Erie County stations in the general vicinity of Tonawanda Creek are given in Table 2.F.

Table 2.F - Air Quality Data
Erie County[2]

Suspended Particulates
Annual Geometric Mean in Micrograms per Cubic Meter

| Station | NYS I.D. | Location | 1970 | 1971 | 1972 | 1973 | 1974 |
|---|---|---|---|---|---|---|---|
| 17 | 1432-01 | Akron Sewage Treatment Plant Kibler Ave.&Lewis Rd., Akron | 38 | 62 | 56 | 48 | 43 |
| 19 | 1451-04 | Amherst Sewage Treatment Plant Tonawanda Creek R., Amherst | -- | 68 | 66 | 52 | 56 |
| 27 | 1472-03 | Green Acres Elementary School 205 Yorkshire Rd., Tonawanda | -- | 80 | 66 | 55 | 57 |
| 28 | 1472-04 | Erie County CAM, Tonawanda Sewage Treatment Plant | 84 | 95 | 85 | 76 | 75 |

Settleable Particulates
Tons per Square Mile per 30 Days

| Station | NYS I.D. | Location | 1970 | 1971 | 1972 | 1973 | 1974 |
|---|---|---|---|---|---|---|---|
| 17 | 1732-01 | Akron Sewage Treatment Plant Kibler Ave. & Lewis Rd., Akron | 7 | 6 | 7 | 8 | 7 |
| 28 | 1472-04 | Erie County CAM, Tonawanda Sewage Treatment Plant, 2 Mile Creek Rd., Tonawanda | 17 | 13 | 12 | 9 | 10 |

Table 2.F (Cont'd)

Sulfation Rates
Annual Arithmetic Mean
Milligrams Sulfate Per Square Centimeter Per 30 Days

| Station | NYS I.D. | Location | 1970 | 1971 | 1972 | 1973 | 1974 |
|---|---|---|---|---|---|---|---|
| 17 | 1432-01 | Akron Sewage Treatment Plant Kibler Ave. & Lewis Rd, Akron | .12 | .17 | .13 | .14 | .18 |
| 19 | 1451-04 | Amherst Sewage Treatment Plant Tonawanda Creek Rd., Amherst | -- | -- | -- | .17 | .49 |
| 27 | 1472-03 | Green Acres Elementary School 205 Yorkshire Rd., Tonawanda | -- | -- | -- | .14 | .20 |
| ?8 | 1472-04 | Erie County CAM, Tonawanda Sewage Treatment Plant 2 Mile Creek Rd., Tonawanda | .77 | .53 | .37 | .40 | .51 |

2.27 Some idea of total suspended particulates (expressed as geometric mean) in Niagara, Genesee and Wyoming Counties was obtained from air sampling station data given in the NYS Department of Environmental Conservation "Twelve Month Statistical Summery"(4) for the sampling period January 1974 - December 1974.

Table 2.G - Suspended Particulate Recordings at Air Monitoring Stations in Niagara, Genesee and Wyoming Counties (Annual Geometric Mean in Micrograms per Cubic Meter)

| Station Location | Suspended Particulates |
|---|---|
| Site 9, In City of Lockport (Niagara County) | 47 |
| Site 2, In City of Batavia (Genesee County) | 46 |
| Site 1, In Village of Attica (Wyoming County) | 31 |

## VEGETATION

2.28 Cursory on-site field observations of vegetation were made in the vicinity of the Batavia Reservoir Compound site by a Corps ecologist during the late fall period 28-29 October 1975. Since authorization to begin an environmental study on the Tonawanda Creek flood control project was not given until the late fall season, random field observations by walking over portions of the area could not be made until late October. The following general locales were spot checked in the field with regard to vegetation outlined in Table 2.H. The area north of the steel road bridge over Tonawanda Creek at Route 20; the area north and south of the Erie-Lackawanna Railroad tracks near Tonawanda Creek; the area south of the Lehigh Valley Railroad tracks from its intersection with the Erie-Lackawanna Railroad tracks east to the general vicinity of Tonawanda Creek.

2.29 In general, vegetation within the Batavia Reservoir Compound site consists of cultivated plants used in dairy farming, and hardwoods, shrubs and herbaceous plants that have naturally established in the area. Interspersed over the area are haylands and pastures established with grasses and legumes; fields used for row crops such as corn; bottomland wooded areas grown to hardwoods; shrublands and interconnected hedgerows of tree-shrub-weed mixtures bordering many of the aforementioned fields. The tree association most often observed along the peripheral banks of Tonawanda Creek in this part of the watershed were Eastern Cottonwood, Box Elder and Black Willow. Scattered wetlands within the Batavia Reservoir Compound contains either standing water year-round or are intermittently wet; sedges, rushes, cattails, iris and woody vegetation are generally associated with these wetlands. On some wetland pockets, iris is a dominant successional species along with cattail.

## FISH, WILDLIFE AND BENTHIC MACROINVERTEBRATES

2.30 General - This portion of the environmental statement lists wildlife fish and benthic macroinvertebrates in portions of the Tonawanda Creek area. Also, refer to Appendix E of this environmental statement, for recent benthic sampling survey information on Tonawanda Creek in Genesee County, done by the Great Lakes Laboratory in March 1976. Since preparation of the environmental statement was authorized in late fall, with limited funding, most of the data presented is based on a review of available existing biological studies that were done on portions of the creek. A field reconnaissance of the Batavia Reservoir Compound site was made by a Buffalo District ecologist on 28-29 October 1975 to make observations on wildlife and to obtain some idea of vegetation (vegetation observations were outlined earlier in this statement). The list of wildlife species observed, as well as species of wildlife not seen but likely to range in the general vicinity of the reservoir compound was coordinated with wildlife biologists of both the Region 8 and Region 9 offices of the New York State Department of Environmental Conservation.

Table 2.H - Terrestrial and Wetland Vegetation Observed in Vicinity of the Batavia Reservoir Compound Site

| Woody Terrestrial Species | Scientific Name |
|---|---|
| Sugar Maple | *Acer saccharum* |
| Red Oak | *Quercus rubra* |
| Black Willow | *Salix nigra* |
| Eastern Cottonwood | *Populus deltoides* |
| Box Elder | *Acer negundo* |
| White Ash | *Fraxinus americana* |
| Quaking Aspen | *Populus tremuloides* |
| American Basswood | *Tilia americana* |
| Ironwood | *Carpinus caroliniana* |
| Elm | *Ulmus* sp. |
| Red Maple | *Acer rubrun* |
| Willow | *Salix* sp. |
| Apple | *Pyrus malus* |
| Tartarian honeysuckle | *Lonicera tatarica* |
| Staghorn sumac | *Rhus typhina* |
| Alder | *Alnus* sp. |
| Hawthorne | *Crateagus* sp. |
| Multiflora Rose | *Rosa multiflora* |
| Red-osier Dogwood | *Cornus stolonifera* |
| Red-Panicle Dogwood | *Cornus racemosa* |
| Wild Grape | *Vitis* sp. |
| Raspberry | *Rubus* sp. |

| Herbaceous Terrestrial Species | Scientific Name |
|---|---|
| Goldenrod | *Solidago* sp. |
| White Snakeroot | *Eupatorium rugosum* |
| Queen Ann's Lace | *Daucus carota* |
| Ragweed | *Ambrosia* sp. |
| Cocklebur | *Xanthium chinense* |
| Common nightshade | *Solanum nigrum* |
| Burdock | *Arctium minus* |
| Coltsfoot | *Tussilaco farfara* |
| Jewelweed | *Impatiens* sp. |
| Violet | *Viola* sp. |
| Yellow Wood Sorrell | *Oxalis europea* |
| Horsetail | *Equisetum* sp. |
| Wild Cucumber | *Echinocystis lobata* |
| Virgin's-Bower | *Clematis virginiana* |
| Milkweed | *Asclepias syriaca* |
| Beggar-Tick | *Bidens* sp. |
| White Sweetclover | *Melilotus albus* |
| Moneywort | *Lysimachia nummularia* |
| Common Dandelion | *Taraxacum officinale* |
| Gill-over-the-ground | *Glechoma hederacea* |

Table 2.H (Cont'd)

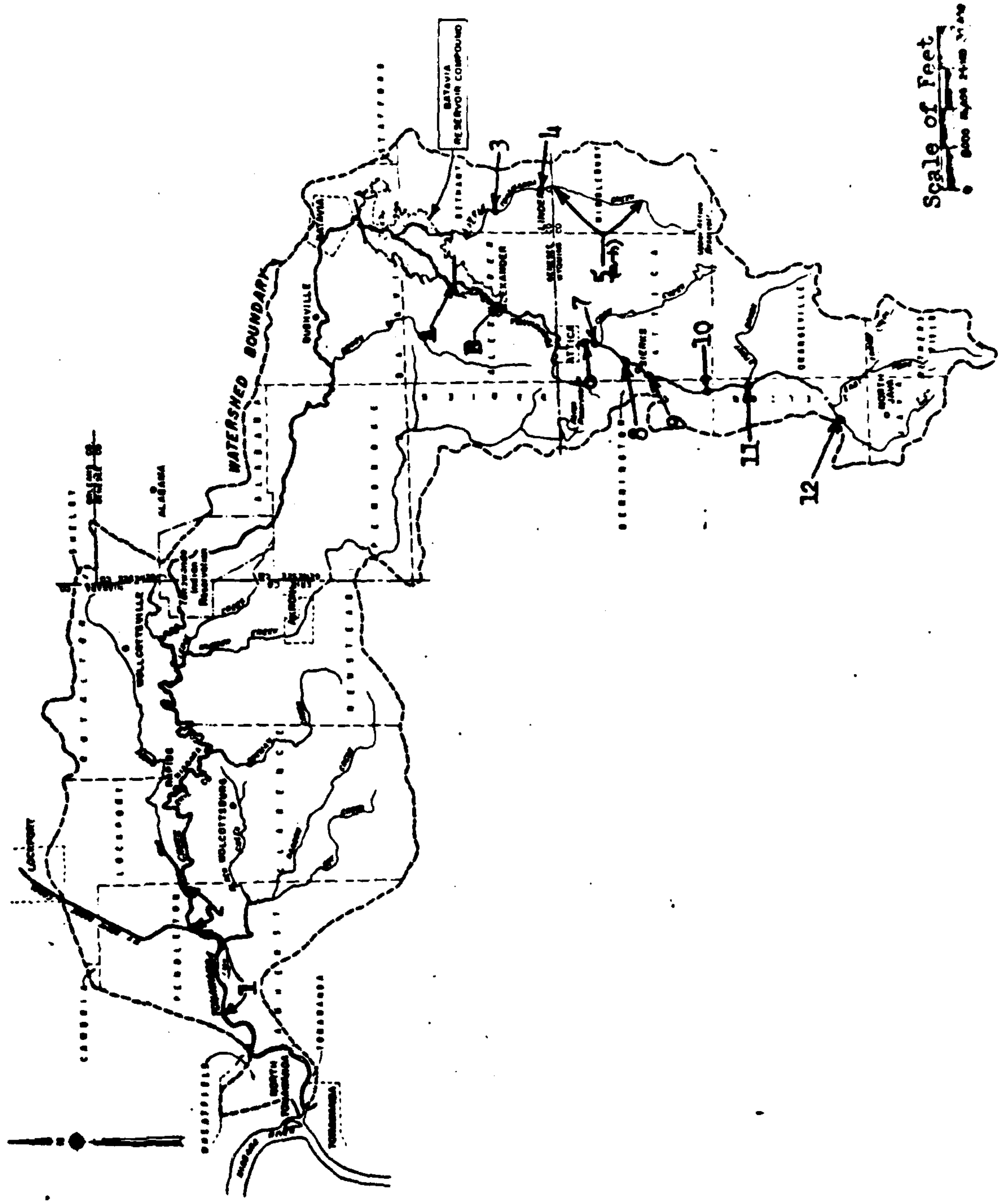
| Herbaceous Terrestrial Species | Scientific Name |
|---|---|
| Common Mullen | Verbascum thapsus |
| Clammy Ground-Cherry | Physalis heterophylla |
| Vervain | Verbena sp. |
| Yarrow | Achillea millefolium |
| Bull Thistle | Cirsium vulgare |
| Curled Dock | Rumex crispus |
| New England Aster | Aster novae-angliae |
| Chickory | Cichorium intybus |
| Iris | Iris sp. |
| Mint | Mentha sp. |
| Evening Primrose | Oenothera biennis |
| Common Strawberry | Fragaria virginiana |
| Meadow-Rue | Thalictrum sp. |
| Aster | Aster sp. |
| Tickseed-Sunflower | Bidens aristosa |
| Spreading Dogbane | Apocynum androsaemifolium |
| Daisy Fleabane | Erigeron annuus |
| Butter-and-Eggs | Linarea vulgaris |
| Wild Mustard | Brasica sp. |
| Sensitive Fern | Onoclea sensibilis |
| *Christmas Fern | Aspidium acrostichoides |
| Panic Grass | Panicum sp. |
| Barnyard Grass | Echinochloa crus-galli |
| Quackgrass | Agropyron repens |
| Orchardgrass | Dactylis glomerata |
| Timothy | Phleum pratense |
| Foxtail | Setaria sp. |
| Alfalfa | Medicago sativa |
| Clover | Trifolium sp. |
| Chickweed | Stellaria sp. |
| **Wetland Vegetation** | **Scientific Name** |
| Reed Canarygrass | Phalaris arundinaceae |
| Common Cattail | Typha latifolia |
| Coontail | Ceratophyllum demersum |
| Elodea | Anacharis sp. |
| Duckweed | Lemna sp. |
| Algae (Filamentous) | Cladophora sp. |
| Rice Cutgrass | Leersia oryzoides |
| Smartweet | Polygonum sp. |

* Native plant protected pursuant to Section 9-1503 of the Environmental Conservation Law. This plant was observed in the vicinity of the Lehigh Valley Railroad tracks, south of the existing railroad embankment. Observed in woodland area just south of Lehigh Valley Railroad embankment.

2.31 Fisheries - The following available fish survey information on Tonawanda Creek and the Little Tonawanda Creek was obtained through the courtesy of fisheries biologists in the New York State Department of Environmental Conservation. Both the Region 8 and Region 9 Fisheries Offices were contacted in November with regard to fish survey sampling data on the above mentioned creeks. Plate 2.9 shows the general sampling site locations, and Table 2.I provides fisheries data collected at the sampling locations, together with equipment used and dates that the surveys were made.

2.32 In general, fish samplings made at stations in the lower portion of the main stem of Tonawanda Creek revealed warm-water species primarily in their collections. Brown trout were found at some sampling stations along upstream sections of the Little Tonawanda Creek. The region 9 office indicated that brown trout are stocked by the NYS Department of Environmental Conservation from the vicinity of Stony Brook just south of the village of Varysburg in Wyoming County, upstream along Tonawanda Creek to about 1 mile upstream of East Fork Creek in Wyoming County. In addition, some brown trout stocking is also done on Little Tonawanda Creek from the West Middlebury Road bridge, to the hamlet of Dale (a distance of approximately 3.2 miles). In general, the area of trout stocking on Little Tonawanda Creek would be in the approximate vicinity of the Linden Reservoir Alternative plan.

2.33 Some early winter fish survey sampling on Tonawanda Creek in Genesee County was done by Corps ecologists on 4 December 1975 (NYS DEC Permit No. SC-1360). At the time of sampling, much of the creek was not accessible due to high flows and swift currents. However, two creek locales were seined (identified as Stations A and B on Plate 2.9), and fish species found are listed in Table 2.J. Water temperature recorded with a Taylor Pocket Thermometer at Station A (a shaded stream section) was $0^{\circ}$ Centigrade, and at Station B (a stream section more exposed to sunlight) was $1^{\circ}$ Centigrade.




Tonawanda Creek, New York

FISH SURVEY
SAMPLING SITE LOCATIONS

Plate 2.9

Table 2.I - NYS DEC Fish Sampling Data
Tonawanda Creek (Main Stem) and Little Tonawanda Creek Tributary

| Sampling Site, Map Number and Date of Survey | Fish Species Noted | | Sampling Equipment Used |
|---|---|---|---|
| <u>Station #1</u> (6/26/73) West Canal Marina 0.3 miles east of Rt. 62 upstream to Barge Canal at hamlet of Pendleton. | Carp | *Cyprinus carpio* | 230 AC Boat Shocker |
| | Goldfish | *Carassius auratus* | |
| | Pumpkinseed | *Lepomis gibbosus* | |
| | Brown Bullhead | *Ictalurus nebulosus* | |
| | Yellow Perch | *Perca flavescens* | |
| | White Sucker | *Catostomus commersoni* | |
| | Central Mudminnow | *Umbra limi* | |
| | Rockbass | *Ambloplites rupestris* | |
| | Largemouth Bass | *Micropterus salmoides* | |
| | White Crappie | *Pomoxis annularis* | |
| | Northern Pike | *Esox lucius* | |
| <u>Station #2</u> (6/26/73) Launch site at West Canal Park 0.3 miles east of Rt. 62. Section shocked 1 mile upstream from point of intersection with Barge Canal | Carp | *Cyprinus carpio* | 230 AC Boat Shocker |
| | Freshwater Drum | *Aplodinotus grunniens* | |
| | Goldfish | *Carassius auratus* | |
| | Pumpkinseed | *Lepomis gibbosus* | |
| | Northern Pike | *Esox lucius* | |
| | Smallmouth Bass | *Micropterus dolomieui* | |
| <u>Station #3</u> (8/15/67) Approximately 200 feet of stream sampled. Bottom - rubble and gravel. No cover. | Rockbass | *Ambloplites rupestris* | Tiny Tiger Shocker |
| | Blacknose Dace | *Rhinichthys atratulus* | |
| | Smallmouth Bass | *Micropterus dolomieui* | |
| | Northern Hogsucker | *Hypentelium nigricans* | |
| | Common Shiner | *Notropis cornutus* | |
| | Creek Chub | *Semotilus atromaculatus* | |

Table 2.[illegible] (cont'd)

| Sampling Site, Map Number and Date of Survey | Fish Species [illegible]ted | | Sampling Equipment Used |
|---|---|---|---|
| Station #4 (8/15/67) | | | |
| On Little Tonawanda Creek, | Rockbass | Ambloplites rupestris | Tiny Tiger DC Shocker |
| Genesee Co. | Smallmouth Bass | Micropterus dolomieui | |
| About 200' of stream sampled. | Blacknose Dace | Rhinichthys atratulus | |
| | White Sucker | Catostomus commersoni | |
| *Station #5a (5/15/67) | | | |
| On Little Tonawanda Creek, Wyoming Co | Rockbass | Ambloplites rupestris | Tiny Tiger DC Shocker |
| About 435' of stream sampled. Bottom- | Blacknose Dace | Rhinichthys atratulus | |
| gravel and silt; banks not stable. | Common Shiner | Notropis cornutus | |
| | White Sucker | Catostomus commersoni | |
| | Northern Hogsucker | Hypentelium nigricans | |
| *Station 5b (8/20/69) | | | |
| On Little Tonawanda Creek, Wyoming Co | Brown trout | Salmo trutta | 220 DC Georator |
| About 350' of stream sampled | Blacknose Dace | Rhinichthys atratulus | |
| | Rockbass | Ambloplites rupestris | |
| | Northern Hogsucker | Hypentelium nigricans | |
| | Pumpkinseed | Lepomis gibbosus | |
| | Creek Chub | Semotilus atromaculatus | |
| | Common Shiner | Notropis cornutus | |
| *Station 5c (8/15/67) | | | |
| On Little Tonawanda Creek, Wyoming Co | Brown trout | Salmo trutta | Tiny Tiger DC Shocker |
| About 435' of stream sampled. | Rockbass | Ambloplites rupestris | |
| | Creek Chub | Semotilus atromaculatus | |
| | Common Shiner | Notropis cornutus | |
| | White Sucker | Catostomus commersoni | |
| | Blacknose Dace | Rhinichthys atratulus | |

* Stations 5a through 5h on Little Tonawanda Creek are located in the general locale of the Linden Reservoir site alternative, with 5a located nearest the Genesee-Wyoming County line; then with sampling proceeding upstream to sampling site 5h. These sampling points were made at locations between the arrows shown for numeral 5 on Plate 2.9.

Table 2.I (Cont'd)

| Sampling Site, Map Number and Date of Survey | Fish Species Noted | | Sampling Equipment Used |
|---|---|---|---|
| *Station #5d (8/15/67) On Little Tonawanda Creek, Wyoming Co. About 435' of stream sampled. Open with no cover; 3 holes. | Brown trout | *Salmo trutta* | Tiny Tiger DC Shocker |
| | Blacknose Dace | *Rhinichthys atratulus* | |
| | White Sucker | *Catostomus commersoni* | |
| | Pumpkinseed | *Lepomis gibbosus* | |
| | Creek Chub | *Semotilus atromaculatus* | |
| | Common Shiner | *Notropis cornutus* | |
| *Station 5e (8/15/67) On Little Tonawanda Creek, Wyoming Co. About 435' of stream sampled. Bottom-gravel and clay. 3 pools; overhead cover over 3/4 of stream. | Rockbass | *Ambloplites rupestris* | Tiny Tiger DC Shocker |
| | Common Shiner | *Notropis cornutus* | |
| | White Sucker | *Catostomus commersoni* | |
| | Creek Chub | *Semotilus atromaculatus* | |
| | Blacknose Dace | *Rhinichthys atratulus* | |
| *Station 5f (8/20/69) On Little Tonawanda Creek, Wyoming Co. About 350' of stream sampled. Mostly well shaded; 1 fair sized pool. | Brown trout | *Salmo trutta* | 220 DC Georator |
| | Pumpkinseed | *Lepomis gibbosus* | |
| | Creek Chub | *Semotilus atromaculatus* | |
| | Blacknose Dace | *Rhinichthys atratulus* | |
| | Northern Hogsucker | *Hypentelium nigricans* | |
| *Station 5g (8/20/69) On Little Tonawanda Creek, Wyoming Co. About 350' of stream sampled. Wide open stream; 1 hole. | Brown Trout | *Salmo trutta* | 220 DC Georator |
| | Blacknose Dace | *Rhinichthys atratulus* | |
| | Creek Chub | *Semotilus atromaculatus* | |
| | Pumpkinseed | *Lepomis gibbosus* | |

* Stations 5a through 5h on Little Tonawanda Creek are located in the general locale of the Linden Reservoir site alternative, with 5a located nearest the Genesee-Wyoming County line; then with sampling proceeding upstream to sampling site 5h. These sampling points were made at locations between the arrows shown for numeral 5 on Plate 2.9.

Table 2.I (Cont'd)

| Sampling Site, Map Number and Date of Survey | Fish Species Noted | | Sampling Equipment Used |
|---|---|---|---|
| *<u>Station 5h</u> (8/20/69) | | | |
| On Little Tonawanda Creek, Wyoming Co | Brown trout | <u>Salmo trutta</u> | 220 DC Georator |
| About 350' of stream sampled. | Blacknose Dace | <u>Rhinichthys atratulus</u> | |
| Heavily silted; sluggish. | Northern Hogsucker | <u>Hypentelium nigricans</u> | |
| | Pumpkinseed | <u>Lepomis gibbosus</u> | |
| | Creek Chub | <u>Semotilus atromaculatus</u> | |
| <u>Station #6</u> (8/11/67) | Smallmouth Bass | <u>Micropterus dolomieui</u> | Tiny Tiger DC Shocker |
| On Tonawanda Creek, Wyoming Co. | Creek Chub | <u>Semotilus atromaculatus</u> | |
| About 100' of stream sampled. | Johnny Darter | <u>Etheostoma nigrum</u> | |
| | Fantail Darter | <u>Etheostoma flabellare</u> | |
| | Rockbass | <u>Ambloplites rupestris</u> | |
| | Northern Hogsucker | <u>Hypentelium nigricans</u> | |
| | Stoneroller | <u>Campostoma anomalum</u> | |
| | Common Shiner | <u>Notropis cornutus</u> | |
| <u>Station #7</u> (8/11/67) | | | |
| On Tonawanda Creek, Wyoming Co. | Northern Hogsucker | <u>Hypentelium nigricans</u> | Tiny Tiger DC Shocker |
| About 100' of stream sampled. | Common Shiner | <u>Notropis cornutus</u> | |
| Bottom consists of rubble and some silt. | Longnose Dace | <u>Rhinichthys cataractae</u> | |
| | Stoneroller | <u>Campostoma anomalum</u> | |
| | Fantail Darter | <u>Etheostoma flabellare</u> | |
| | Northern Pike | <u>Esox lucius</u> | |

* Same as footnote on preceeding page.

Table 2.I (Cont'd)

| Sampling Site, Map Number and Date of Survey | Fish Species Noted | | Sampling Equipment Used |
|---|---|---|---|
| **Station #8** (8/11/67) | | | |
| On Tonawanda Creek, Wyoming Co. | Northern Hogsucker | Hypentelium nigricans | Tiny Tiger DC Shocker |
| About 100' of stream sampled. | Common Shiner | Notropis cornutus | |
| | Stoneroller | Campostoma anomalum | |
| | Fantail Darter | Etheostoma flabellare | |
| | Rockbass | Ambloplites rupestris | |
| **Station #9** (8/11/67) | | | |
| On Tonawanda Creek, Wyoming Co. | Northern Hogsucker | Hypentelium nigricans | Tiny Tiger DC Shocker |
| Bottom consists of rubble with some silt. | Common Shiner | Notropis cornutus | |
| About 100' of stream sampled. | Stoneroller | Campostoma anomalum | |
| | Rockbass | Ambloplites rupestris | |
| | Fantail Darter | Etheostoma flabellare | |
| | Redside Dace | Clinostomus elongatus | |
| | Longnose Dace | Rhinichthys cataractae | |
| | Blacknose Dace | Rhinichthys atratulus | |
| | Creek Chub | Semotilus atromaculatus | |
| **Station #10** (8/11/67) | Rockbass | Ambloplites rupestris | Tiny Tiger DC Shocker |
| On Tonawanda Creek, Wyoming Co. | Creek Chub | Semotilus atromaculatus | |
| Stream open with very little overhead cover. Bottom consists of rubble with some silt. About 100' of stream sampled. | Northern Hogsucker | Hypentelium nigricans | |
| | Common Shiner | Notropis cornutus | |
| | Stoneroller | Campostoma anomalum | |
| | Fantail Darter | Etheostoma flabellare | |
| | Blacknose Dace | Rhinichthys atratulus | |
| | Longnose Dace | Rhinichthys cataractae | |

Table 2.I (Cont'd)

| Sampling Site, Map Number and Date of Survey | Fish Species Noted | | Sampling Equipment Used |
|---|---|---|---|
| <u>Station #11</u> (7/12/74) | Brown Trout | *Salmo trutta* | |
| On Tonawanda Creek, Wyoming Co. | Northern Hogsucker | *Hypentelium nigricans* | 230 Georator |
| Cover poor to fair (wide, open | White Sucker | *Catostomus commersoni* | |
| section). Shelter good, much shelter | Creek Chub | *Semotilus atromaculatus* | |
| provided by large instream boulders. | Common Shiner | *Notropis cornutus* | |
| Layer of silt on stream bottom. | Fantail Darter | *Etheostoma flabellare* | |
| About 435' of stream sampled. | Blacknose Dace | *Rhinichthys atratulus* | |
| | Longnose Dace | *Rhinichthys cataractae* | |
| | Redside Dace | *Clinostomus elongatus* | |
| | Stoneroller | *Campostoma anomalum* | |
| <u>Station #12</u> (7/12/74) | | | |
| On Tonawanda Creek, Wyoming Co. | Creek Chub | *Semotilus atromaculatus* | 230 DC Georator |
| About 435' of stream sampled. | Common Shiner | *Notropis cornutus* | |
| Cover and shelter very good (Willows | Blacknose Dace | *Rhinichthys atratulus* | |
| and alders, undercut bank). | Longnose Dace | *Rhinichthys cataractae* | |
| | White Sucker | *Catostomus commersoni* | |
| | Northern Hogsucker | *Hypentelium nigricans* | |
| | Fantail Darter | *Etheostoma flabellare* | |
| | Mottled Sculpin | *Cottus bairdi* | |
| | Brown Trout | *Salmo trutta* | |

Table 2.J - Early Win. Fish Seining Survey
Tonawanda Creek (Main Stem), Genesee County - 1975

| Sampling Site, Map Letter and Date of Survey | Fish Species Noted | | Sampling Equipment Used |
|---|---|---|---|
| **Station A** (12/4/75) Pool area located downstream 350' north of Peaviner Road bridge in Genesee County. Stream width about 20'; pool depth 3'+. About 40' of stream sampled. Banks steep, scoured exposed tree and shrub roots; some slight bank undercutting. Top of banks adjoining stream consists of young boxelder trees that provide some overhanging shade. Stream bottom consists of boulders and silt. | Common Shiner | *Notropis cornutus* | 12' Seine, 1/8" mesh |
| **Station B** (12/4/75) Pool-riffle area located approximately 100' upstream (south) of Route 20 road bridge in Genesee County, NY. Stream width about 50'; riffles 1-1/2' deep; pools 3-1/2' deep. About 200' of stream sampled. Banks steep, scoured, exposed tree and shrub roots; some slight bank undercutting. Top of banks adjoining stream consists of young boxelder and eastern cottonwood trees that provide fair overhanging shade. Stream bottom consists of sand, gravel, silt; some fallen tree branches in stream. | Hog Sucker<br>Fallfish<br>Creek Chub<br>Common Shiner<br>Bluntnose Minnow<br>Stoneroller Minnow | *Hypentilium nigricans*<br>*Semotilus corporalis*<br>*Semotilus atromaculatus*<br>*Notropis cornutus*<br>*Pimephales notatus*<br>*Campostoma anomalum* | 12' Seine, 1/8" mesh |

* All species observed (at both Station A and B) were represented by young of the year. *Semotilus corporalis* and *Pimephales notatus* also included one adult fish each in the seine catch.

2.34 Wildlife - Table 2K shows wildlife species observed in the flood plain locale of the proposed Batavia Reservoir Compound site, during an October 28-29 field reconnaissance survey.

Table 2K - Wildlife Observations on the Batavia Reservoir Compound Site

| | Scientific Name |
|---|---|
| **Mammals** | |
| Raccoon (tracks seen only) | Procyon lotor |
| White-tailed Deer (tracks seen only) | Odocoileus virginianus |
| Muskrat (tracks and burrows seen only) | Ondotra zibethica |
| Woodchuck (tracks and burrows seen only) | Marmota monax |
| Eastern Cotton Rabbit | Sylvilagus floridanus |
| Eastern Chipmunk | Tamias striatus |
| Red Squirrel | Tamiasciurus hudsonicus |
| Eastern Gray Squirrel | Sciurus carolinensis |
| **Reptiles** | |
| Eastern Painted Turtle | Chrysemys picta picta |
| **Birds** | |
| Mallard | Anas platyrhynchos |
| Black Duck | Anas rubripes |
| Ring-necked Pheasant | Phasianus colchicus |
| Common Flicker | Colaptes auratus |
| Hairy Woodpecker | Dendrocopus villosus |
| Downy Woodpecker | Dendrocopus pubescens |
| Barn Swallow | Hirundo rustica |
| Blue Jay | Cyanocitta cristata |
| Common Crow | Corvus brachyrhynchos |
| Black-capped Chickadee | Parus atricapillus |
| American Robin | Turdus migratorius migratorius |
| Starling | Sturnus vulgaris |
| Eastern Golden-crowned Kinglet | Regulus satrapa satrapa |
| Rusty Blackbird | Euphagus carolinus |
| Red-winged Blackbird | Agelaius phoeniceus |
| Common Grackle | Quiscalus quiscula |
| Slate-colored Junco | Junco hyemalis |
| Cardinal | Cardinalis cardinalis |
| Eastern Tree Sparrow | Spizella arborea arborea |
| White-crowned Sparrow | Zonotrichia leucophrys |
| Song Sparrow | Melospiza melodia |
| Eastern Mourning Dove | Zenaida macroura |
| White-breasted Nuthatch | Sitta carolinensis |

2.35 Although the following mammals in Table 2.L were not actually observed on the Reservoir Compound site during the 28-29 October field reconnaissance, the potential project site falls within the general range of these species. The list was coordinated with the Region 8 Conservation Biologist of the NYS Deparmtent of Environmental Conservation.

Table 2.L - Other Mammal Species That Have Ranges Which May Include the Batavia Reservoir Compound Site

| | |
|---|---|
| Opossum | Didelphis marsupialis |
| Raccoon | Procyon lotor |
| Short-tail Weasel | Mustela erminea |
| Long-tail Weasel | Mustela frenata |
| Least Weasel | Mustela rixosa |
| Mink | Mustela vison |
| Eastern Skunk | Mephitis mephitis |
| Red Fox | Vulpes fulva |
| Gray Fox | Urocyon cinereoargenteus |
| Flying Squirrel | Glaucomus volans |
| Deer Mouse | Peromyscus vermiculatus |
| Deer Mouse or Meadow Vole | Microtus pennsylvanicus |
| House Mouse | Mus musculus |
| Norway Rat | Rattus norvegicus |

2.36 Coordination with the Region 8 Conservation Biologist of the NYS Department of Environmental Conservation, provided the following additional guidance with regard to wildlife in the project site and also the "Alabama Pools" alternative.

2.37 a. There are a number of significant wetland areas within the Batavia Compound site that are utilized as nesting and breeding areas for several species of waterfowl and variety of avian species. Such wetlands have dense stands of cattail and critical pheasant wintering areas for birds inhabiting the local area. Some of the farmers in the potential project area also depend on these wetland areas for stock watering, and to some degree, fire protection. A wetland Location Map (Source: 1950 U.S.G.S. Batavia South, NY, Quadrangle, Series V821) is provided in Appendix G of this environmental statement.

2.38 b. Osprey, bald eagles and golden eagles have been seen on a regular basis in areas around the Iroquois National Wildlife Refuge and the Tonawanda Wildlife Management area. The "Alabama Pools" alternative is located in this area. The Tonawanda Wildlife Management Area is owned and operated by the New York State Department of Environmental Conservation principally as a Waterfowl Management Area, although some terrestrial

lands on this area are used for some hunting of upland game species. See Appendix B, pages B-5, B-6 and B-11 for a further brief description of this wildlife Area (under "Alabama Pools" alternative) by the U. S. Fish and Wildlife Service and NYSDEC. An American Peregrine Falcon was also recently seen on the Tonawanda Wildlife Management area. The Region 8 Conservation Biologist familiar with the general flood plain area of the project site indicated that, although no known nesting sites of any of the above-mentioned species can be identified as being within the Tonawanda Creek Watershed, suitable habitat does exist in the basin to support a breeding population of one or more of these species.

2.39 c. An otter road kill northeast of Alexander was reported to the NYS Deaprtment of Environmental Conservation in 1974. Subsequent investigation revealed that a family of otters may have been present in the area, and perhaps might still be.

2.40 d. Beaver are present on occasion on the Tonawanda Creek and its tributaries. There was a known active beaver colony in the general locale of Old Creek Road and the Erie-Lackawanna Railroad about three years ago, but signs of recent activity in this vicinity are not present.

2.41 e. Waterfowl hunting is done on the Tonawanda Creek, its tributaries and related wetland areas by local hunters. The magnitude of the number of ducks and geese harvested and the number of man-days of recreation provided is unknown. However, waterfowl hunting on the Tonawanda Wildlife Management Area in north-eastern Genesee County does provide approximately 2500 man-days of recreation annually with an annual harvest of approximately 1500 ducks and geese. The Tonawanda Creek forms a portion of the southern boundary of this state land area.

2.42 f. Amphibians and reptiles that the Region 8 Conservation biologist was sure of as present in the Batavia Reservoir Compound site are such species as the Mudpuppy (Necturus maculosus), Spotted Salamander (Ambystoma maculatum) Red-Spotted or Crimson-Spotted Newt (Diemictylus viridescens viridescens), Red Eft (the terrestrial stage of the Red-Spotted or Crimson-Spotted Newt), Slimy Salamander (Plethodon glutinosus glutinosus), Common or American Toad (Bufo americanus), Gren Frog (Rana clamitans melonota), Leopard Frog (Rana pipiens), Pickerel Frog (Rana palustris), Wood Frog (Rana sylvatica), Snapping Turtle (Chelydra serpentina), Painted Turtle (Chrysemys picta), Common Water Snake or Northern Water Snake (Natrix sipedon sipedon), and Milk Snake (Lampropeltis doliata triangulum).

2.43 In a letter dated 18 December 1975, the New York State Department of Environmental Conservation, Region 9 Wildlife Unit brought to the Corps attention their concern for a major deer wintering area, that has been identified in the Tonwanda Creek valley, between the Sierks reservoir dam site and Varysburg in Wyoming County. A general outline

of the area of concern is provided together with the letter in Appendix B, "Letters of Coordination."

2.44 Birds - To date, 384 species of birds have been recorded in the Niagara Frontier Region[7]. Of these, 24 species are permanent residents, 8 are introduced permanent residents, 118 are summer residents, 3 are summer visitants, 38 are winter visitants, 114 are transient visitants, 10 are rare or very rare visitants, 24 are casual or sporadic vicitants. 44 are accidential visitants and one species is considered to be an introduced rare transient visitant. Bird species found in the region are discussed in more detail in references entitled, Birds of the Niagara Frontier Region (Beardslee and Mitchell, 1965)[6] and Birds of the Niagara Frontier Region Supplement (Mitchell and Anderle, 1970)[7].

2.45 In general, noticeable bird migration usually begins about March, as some of the winter visitants leave for the north; at this time, migration of birds also occurs from the south, which includes waterfowl, some birds of prey and some land birds. During April and May, bird migration on the Niagara Frontier reaches its peak with the spring waterfowl flight, shorebird migration and the arrival of seedeaters and insectivorous birds.

THREATENED OR POSSIBLY THREATENED FISH AND WILDLIFE

2.46 A letter of coordination dated 1 December 1975 from the Region 9 office of the New York State Department of Environmental Conservation listed the following species to be considered rare or endangered in the Tonawanda Creek Drainage according to Part 182, Section 1, Endangered Species List of the Conservation Law 1-31-71.

a. Mammals

Indiana Bat - Mayotis sodalis
Eastern Timber Wolf - Canis lupus lycaon

b. Birds

American Peregrine Falcon - Falco peregrinus anatum
Southern Bald Eagle - Haliaeetus l. leucocephalus

c. Reptiles and Amphibians

Bog Turtle - Clemmys muhlenbergi

d. *Fish

Shortnose Sturgeon - Acipensei brevirostrum
Blue Pike - Stizostedion vitreum glaucum

* Note - As indicated in the letter of coordination, the above mentioned fish species are probably not found in the Watershed, but are native to New York State. Therefore, they were included in the list.

2.47 The 1973 edition of "Threatened Wildlife of the United States"[(8)] as published by the Bureau of Sport Fisheries and Wildlife, U.S. Department of the Interior, describes the status of vertebrate species and subspecies whose existence are threatened. This reference source was checked for any official listings of species whose distribution range may include the vicinity of Western New York. The seven aforementioned species were included in this reference and their present distribution and status are indicated below. In addition, the "United States List of Endangered Fauna" dated May 1974[(9)] was also checked as to where these species are found --- "where found", as given in the May 1974 publication, is shown in parenthesis following the present distribution and status of each species (except for the bog turtle which was not shown in the May 1974 publication). The Federal Register dated 26 September 1975 containing a list of Endangered and Threatened Wildlife and Plants was also consulted.

2.48 Indiana Bat - Its present distribution is in the Midwest and Eastern United States from the western edge of the Ozark region in Oklahoma to central Vermont, to southern Wisconsin and as far south as northern Florida. Distribution is associated with major cavernous limestone areas and areas just north of cave regions. Status - Decreasing in numbers. (Where found according to May 1974 publication - U.S.A. (Midwest and East)).

2.49 Eastern Timber Wolf- Its present distribution is in the Lake Superior region of Michigan and the International border region of Minnesota; Isle Royale, Michigan; Ontario, Canada, north to James Bay, eastward to Gulf of St. Lawrence. One specimen was taken in 1968 in Fulton County, NY; prior to that, the last authentic record of the wolf in New York was in 1899. Status - Greatly reduced in range and numbers in the conterminous United States, but stable in Minnesota. (Where found according to May 1974 publication - Canada (E)/U.S.A. (NE-Minnesota, MI)).

2.50 American Peregrine Falcon - Breeds from non-Arctic portions of Alaska and Canada south to Baja California (except coast of southern Alaska and British Columbia), central Arizona and Mexico (locally); eastern limits presently follow eastern front of Rocky Mountains in the U.S.; distribution local in the southern boreal forests of Canada and a few pairs still breed in Labrador. Winters chiefly in breeding range, but more northern birds move to south. Status - Extirpated as a breeding bird east of the Rocky Mountains in the United States, in Ontario, southern Quebec, and the Maritimes. (Where found according to May 1974 publication - Canada/U.S.A./Mexico).

2.51 Southern Bald Eagle - Nests primarily in estuarine areas of Atlantic and Gulf coasts, locally from New Jersey to Texas and lower Mississippi valley southward from eastern Arkansas and western Tennessee, and through southern states west to California and Baja California. Some birds wander northward in summer after nesting season

to northern United States and southeastern Canada. Status - Generally decreasing. Reproduction apparently less successful than formerly except in Everglades National Park, where about 52 pairs nested in 1965 with a success of 50 percent and a production of 1.46 young per successful nest. (Where found according to May 1974 publication - U.S.A. (South of 40th Parallel)).

2.52 Bog Turtle - Its present distribution is in the isolated colonies from Connecticut to southwestern North Carolina, restricted to freshwater marshes, meadows and bogs. Although Conant's "Field Guide to Reptiles and Amphibians"[10] includes portions of New York State within the habitat range of this reptilian species, the map provided in this reference source outlines the approximate range to be somewhat more to the east of the Tonawanda Creek watershed. Status - Very uncommon in most localities.

2.53 Shortnose Sturgeon - All recent U. S. records are from the Hudson River except one Florida specimen. Status - In peril. The species is gone in most of the rivers of its former range. Is probably not yet extinct. (Where found according to May 1974 publication - U.S.A./Canada: Atlantic Coast).

2.54 Blue Pike - Very uncommon in the deeper and cooler areas of Lake Erie and possibly Lake Ontario. Status - Threatened. Although a few hundred pounds of blue pike have been listed in the catch of commercial fishermen in recent years, biologists have found that these were mostly small yellow pike. (Where found according to May 1974 publication - U.S.A. (Lakes Erie and Ontario)).

WATER QUALITY AND BENTHIC ORGANISMS

2.55 New York State Department of Environmental Conservation Water Quality Classifications and Standards - Classifications and Standards Governing the Quality and Purity of Waters in New York State[11], dated 27 March 1974, describes the various stream classifications and indicates criteria for water quality in each stream class category as to their best use. Upon coordination with the NYS Department of Environmental Conservation[12], it was noted that the following classifications have been presently assigned to Tonawanda Creek and Little Tonawanda Creek:

Tonawanda Creek

Class B - Mouth to Dam at East Pembroke.
Class C - East Pembroke to Water Supply Dam at Batavia.
Class A - Batavia to Source.

Little Tonawanda Creek

Class A - Mouth to Pond 16D.
Class AT- Pond 16D at Hamlet of Linden to Hamlet of Dale.
Class A - Hamlet of Dale to source.,

The above classifications are described below:

CLASS "A"

Best Usage of waters - Source of water supply for drinking, culinary or food processing purposes and any other usages.

Conditions related to best usage of waters - The waters, if subjected to approved treatment equal to coagulation, sedimentation, filtration and disinfection, with additional treatment if necessary to reduce naturally present impurities will meet New York State Department of Health drinking water standards and will be considered safe and satisfactory for drinking water purposes.

Quality Standards for Class "A" Waters

| Items | Specifications |
|---|---|
| 1. Coliform | The monthly median coliform value for one hundred ml of sample shall not exceed five thousand from a minimum of five examinations and provided that not more than twenty percent of the samples shall exceed a coliform value of twenty thousand for one hundred ml of sample and the monthly geometric mean fecal coliform value for one hudred ml of sample shall not exceed two hundred (200) from a minimum of five examinations. |
| 2. pH | Shall be between 6.5 and 8.5. |
| 3. Total Dissolved Solids | Shall be kept as low as practicable to maintain the best usage of waters, but in no case shall it exceed 500 milligrams per liter. |
| 4. Dissolved Oxygen | For cold waters suitable for trout spawning, the DO concentration shall not be less than 7.0 mg/1 from other than natural conditions. For trout waters, the minimum daily average shall not be less than 6.0 mg/1. At no time shall the DO concentration be less than 5.0 mg/1. For non-trout waters, the minimum daily average shall not be less than 5.0 mg/1. At no time shall the DO concentration be less than 4.0 mg/1. |

Quality Standards for Class "A" Waters (Cont'd)

| Items | Specifications |
|---|---|
| 5. Phenolic Compounds | Shall not be greater than 0.005 milligrams per liter (Phenol). |
| 6. Radioactivity | |
| a. Gross Beta | Shall not exceed 1,000 picocuries per liter in the absence of $Sr^{90}$ and alpha emitters. |
| b. Radium 226 | Shall not exceed 3 picocuries per liter. |
| c. Strontium 90 | Shall not exceed 10 picocuries per liter. |

## Class "AT"

Quality Standards for Class AT waters are the same as for Class A waters, except that Class AT waters are trout inhabited.[13]

## Class "B"

Best usage of waters - Primary contact recreation and any other uses except as a source of water supply for drinking, culinary or food processing purposes.

Quality Standards for Class "B" Waters

| Items | Specifications |
|---|---|
| 1. Coliform | The monthly median coliform value for one hundred ml of sample shall not exceed two thousand four hundred from a minimum of five examinations and provided that not more than twenty percent of the samples shall exceed a coliform value of five thousand for one hundred ml of sample and the monthly geometric mean fecal coliform value for one hudnred ml of sample shall not exceed two hundred (200) from a minimum of five excaminations. This standard shall be met during all periods when disinfection is practiced. |

## Quality Standards for Class "B" Waters (Cont'd)

| Items | Specifications |
|---|---|
| 2. pH | Shall be between 6.5 and 8.5. |
| 3. Total Dissolved Solids | None at concentrations which will be detrimental to the growth and propagation of aquatic life. Waters having present levels less than 500 milligrams per liter shall be kept below this limit. |
| 4. Dissolved Oxygen | For cold waters suitable for trout spawning, the DO concentration shall not be less than 7.0 mg/l from other than natural conditions. For trout waters, the minimum daily average shall not be less than 6.0 mg/l. At no time shall the DO concentration be less than 5.0 mg/l. For non-trout waters, the minimum daily average shall not be less than 5.0 mg/l. At no time shall the DO concentration be less than 4.0 mg/l. |

## Class "C"

Best usage of waters - Suitable for fishing and all other uses except as a source of water supply for drinking, culinary or food processing purposes and primary contact recreation.

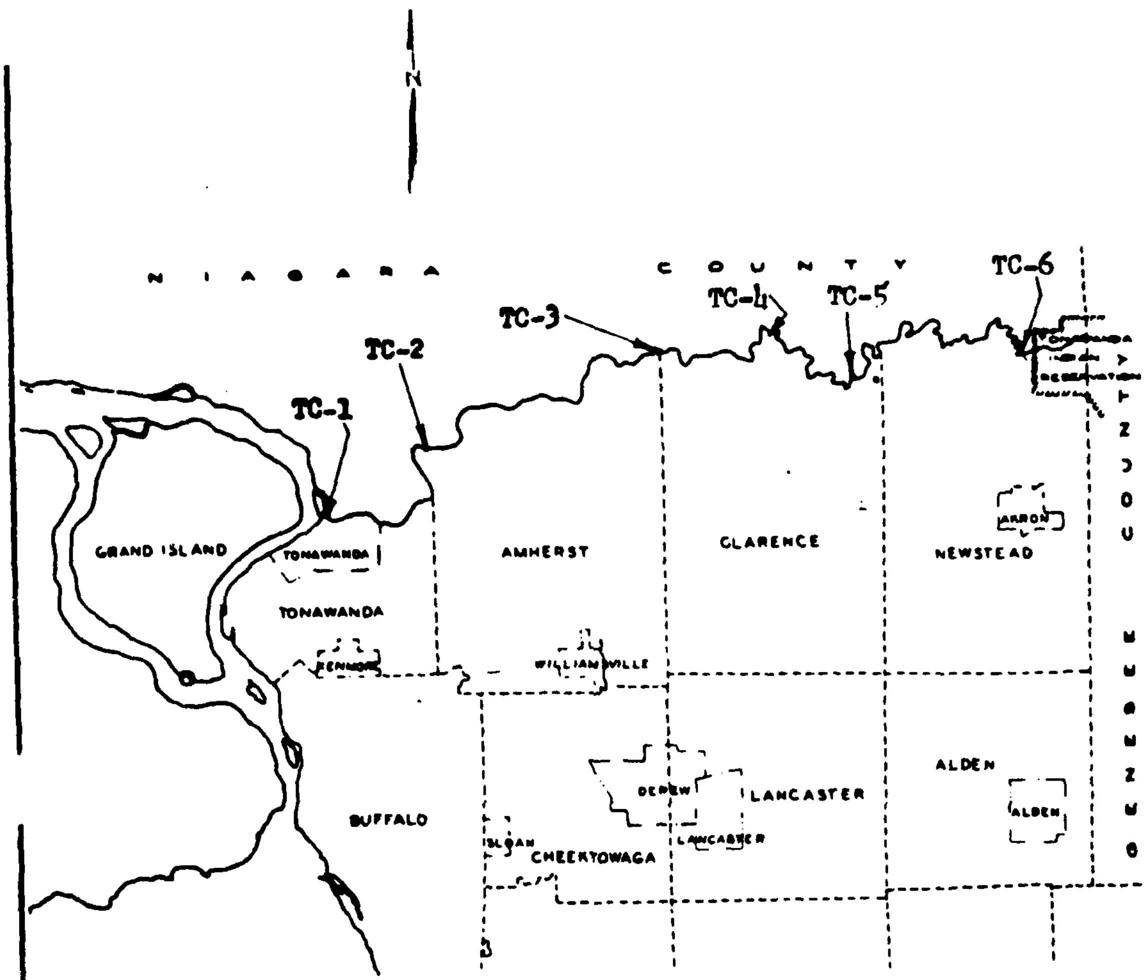
## Quality Standards for Class "C" Waters

| Items | Specifications |
|---|---|
| 1. Coliform | The monthly geometric mean total coliform value for one hundred ml of sample shall not exceed ten thousand and the monthly geometric mean fecal coliform value for one hundred ml of sample shall not exceed two thousand from a minimum of five examinations. This standard shall be met during all periods when disinfection is practiced. |
| 2. pH | Shall be between 6.5 and 8.5. |

Quality Standards for Class "C" Waters (Cont'd)

| Items | Specifications |
|---|---|
| 3. Total Dissolved Solids | None at concentrations which will be detrimental to the growth and propagation of aquatic life. Waters having present levels less than 500 milligrams per liter shall be kept below this limit. |
| 4. Dissolved Oxygen | For cold waters suitable for trout spawning, the DO concentration shall not be less than 7.0 mg/l from other than natural conditions. For trout waters, the minimum daily average shall not be be less than 6.0 mg/l. At no time shall the DO concentration be less than 5.0 mg/l. For non-trout waters, the minimum daily average shall not be less than 5.0 mg/l. At no time shall the DO concentration be less than 4.0 mg/l. |

2.56 1970 Stream Survey Erie County Department of Health(14) - This survey inventoried the surface waters of 27 streams in Erie County, one of which was Tonawanda Creek. From the samples taken during June, July and August, 1970 (refer to Plate 2.10 for sample station locations), on the spot determinations of dissolved oxygen (DO) in the water, the water temperature and percentage of dissolved oxygen saturation were made. Specimen samples were also taken to the laboratory and biochemical oxygen demand (BOD), the phosphate, nitrate, chloride and fecal coliform content of each sample were determined. Table 2.M shows the maximum, minimum and median measurements found for BOD (in mg/liter), DO (in mg/liter), percent saturation DO, phosphates as phosphorus (in mg/liter), nitrates as nitrogen (in mg/liter, chloride (in mg/liter) and fecal coliforms (count/100 milliliter sample). Sampling station locations TC-1 through TC-6 are given in Table 2.M and are located on Plate 2.10.




Tonawanda Creek, New York

STREAM SAMPLING STATIONS
1970 Stream Survey (11)

Plate 2.10

Table 2.M - 1970 Stream Survey
Water Quality Chemistry Determinations
Maximum, Minimum and Median Values

| Variable Stream | 1 BOD | 2 DO | 3 % SAT - DO | 4 $PO_4$ | 5 $NO_3$ | 6 Cl | 7 FeColi |
|---|---|---|---|---|---|---|---|
| TC 1 MEAN | 3.5875 | 7.5667 | 88.3030 | 0.1642 | 2.50 | 30.5883 | 989.6364 |
| MAX | 4.40 | 9.80 | 108.0 | 0.640 | 6.10 | 50.0 | 4320.0 |
| MIN | 2.70 | 8.0 | 73.0 | 0.030 | 1.70 | 25.0 | 4.0 |
| MED | 3.60 | 7.40 | 85.0 | 0.130 | 2.10 | 27.50 | 72.0 |
| | Rt. 25 & Sweeney St. | | | | | | |
| TC 2 MEAN | 2.8444 | 4.8970 | 57.0909 | 0.350 | 3.0364 | 39.9583 | 4427.27 |
| MAX | 4.20 | 8.0 | 90.0 | 0.560 | 6.10 | 85.0 | 20000.0 |
| MIN | 2.0 | 2.80 | 34.0 | 0.020 | 1.90 | 32.50 | 400.0 |
| MED | 2.80 | 4.70 | 53.0 | 0.32 | 2.60 | 37.25 | 3200.0 |
| | Niagara Falls Blvd. & Rt. 425 | | | | | | |
| TC 3 MEAN | 3.1250 | 8.10 | 94.9091 | 0.3018 | 5.7818 | 47.9545 | 251.9167 |
| MAX | 4.90 | 13.0 | 154.0 | 0.80 | 8.90 | 75.0 | 1450.0 |
| MIN | 1.9 | 3.5 | 38.0 | 0.010 | 3.40 | 35.0 | 50.0 |
| MED | 2.75 | 8.0 | 93.0 | 0.28 | 5.20 | 47.5 | 120.0 |
| | Tonawanda Creek Rd. & Transit Rd. | | | | | | |
| TC 4 MEAN | 3.750 | 6.9788 | 78.4848 | 0.3517 | 6.5455 | 45.00 | 421.8182 |
| MAX | 6.50 | 10.80 | 124.0 | 0.650 | 9.40 | 70.0 | 2000.0 |
| MIN | 1.80 | 3.40 | 41.0 | 0.090 | 2.80 | 10.0 | 100.0 |
| MED | 3.750 | 7.0 | 79.0 | 0.350 | 6.30 | 45.0 | 270.0 |
| | Tonawanda Creek Rd. & Goodrich Rd. | | | | | | |

**Note:** Units of BOD, DO, $PO_4$, $NO_3$, and CL are in milligrams/liter. As given on page 4 of the 1970 Stream Survey report, FeColi are based on the State's standard of 2,400 coliforms/100 milliliters of water sample.

Table 2.M (Cont'd

| Variable Stream | 1 BOD | 2 DO | 3 % SAT - DO | 4 $PO_4$ | 5 $NO_3$ | 6 Cl | 7 FeColi |
|---|---|---|---|---|---|---|---|
| TC 5 MEAN | 3.5375 | 7.2970 | 81.6364 | 0.3775 | 6.8636 | 52.7083 | 286.3636 |
| MAX | 7.70 | 9.90 | 113.0 | 0.70 | 12.10 | 100.0 | 1100.0 |
| MIN | 1.90 | 5.70 | 69.0 | 0.040 | 2.80 | 32.50 | 60.0 |
| MED | 3.10 | 7.30 | 80.0 | 0.420 | 7.80 | 47.50 | 180.0 |
| | Rapids Rd. & Tonawanda Creek Rd. | | | | | | |
| TC 6 MEAN | 2.550 | 7.2719 | 88.0625 | 0.3673 | 5.8909 | 65.6818 | 797.9091 |
| MAX | 3.20 | 8.50 | 138.0 | 0.80 | 9.60 | 82.50 | 5240.0 |
| MIN | 1.40 | 1.20 | 80.0 | 0.010 | 2.40 | 35.0 | 100.0 |
| MED | 2.650 | 7.20 | 85.0 | 0.420 | 6.50 | 70.0 | 250.0 |
| | Cedar St. & Kaepsel Rd. | | | | | | |

2.57 1973 Erie County Department of Health Survey[15] - During the summer of 1973, an environmental health survey of Erie County was conducted by the Erie County Laboratory, Public Health Division of the Erie County Department of Health. This survey was a follow-up of the original stream survey done in 1970. Three stations on Tonawanda Creek were sampled, using one of the 1970 sample sites and two new sites. Sampling stations used in the survey are identified as TC-1A, TC-2 and TC-2A, and their locations are given in Table 2.0 and on Plate 2.11. Samples were taken during normal daytime working hours. Where the stream was wadeable, water samples were collected using a one-half gallon jug; where the stream was too deep, either a Kemmerer or Van Corn sampler was used. Samples were collected approximately three times per week during 1970 summer months and on a weekly basis during 1973 summer months. Water chemistry in Table 2.N and 2.0, on Plates 2.12, 2.13 and 2.14, and biological aspects in Tables 2.P and 2.Q were derived from the 1973 survey and are presented below.

Table 2.N - Tonawanda Creek, Erie County - Water Quality:[15]
Data Comparison, 1970-1973 Stream Surveys

| Site | 1970 | Total Phosphate as Phosphorus: 1973 | % change |
|---|---|---|---|
| TC-1A | * | 0.14 mg/l | - - - |
| TC-2 | 0.35 mg/l | 0.17 | - 49 |
| TC-2A | * | 0.14 | - - - |

| Site | 1970 | Biochemical Oxygen Demand 1973 | % change |
|---|---|---|---|
| TC-1A | * | 1.9 mg/l | - - - |
| TC-2 | 2.8 mg/l | 1.6 | - 43 |
| TC-2A | * | 1.6 | - - - |

| Site | 1970 | Dissolved Oxygen 1973 | % change |
|---|---|---|---|
| TC-1A | * | 6.9 mg/l | - - - |
| TC-2 | 4.9 mg/l | 6.1 | + 25 |
| TC-2A | * | 5.4 | - - - |

* Not a sample point in 1970

$$\frac{\text{1970 value - 1973 value}}{\text{1970 value}} = \text{\% change}$$

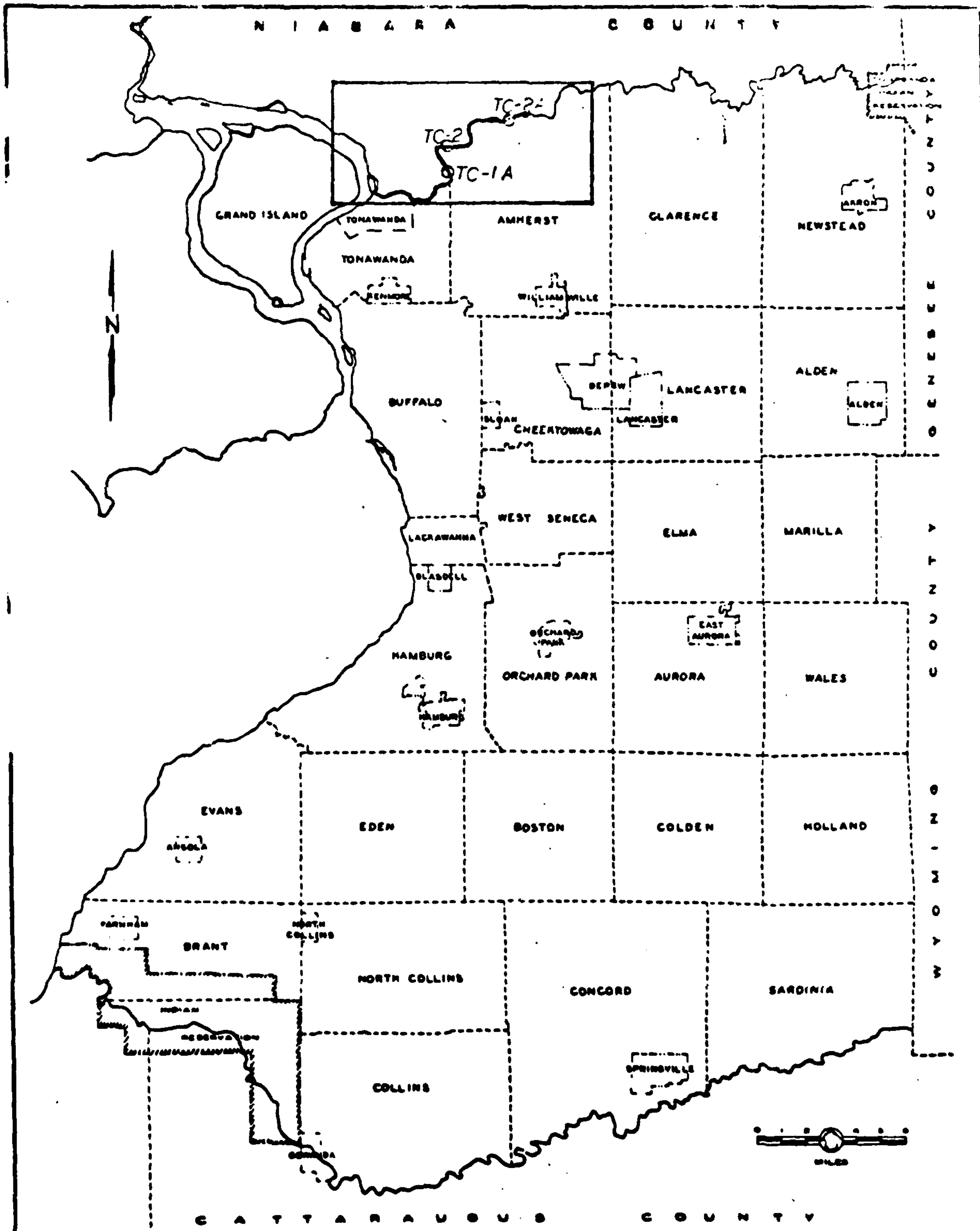
Table 2.0 - Tonawanda Creek, Erie County
Chemical Data 1973 (15)

| Site | Biochemical Oxygen Demand | Dissolved Oxygen | Percent Oxygen Saturation | Total Phosphate As Phosphorus | Ortho Phosphate As Phosphorus |
|---|---|---|---|---|---|
| TC-1A East Robinson Road | | | | | |
| MEAN | 1.9 mg/l | 6.9 mg/l | 82% | 0.14 mg/l | 0.07 mg/l |
| MAX | 2.8 | 8.1 | 85 | 0.19 | 0.11 |
| MIN | 0.2 | 5.8 | 69 | 0.10 | 0.04 |
| MED | 2.0 | 6.7 | 81 | 0.14 | 0.07 |
| TC-2 Niagara Falls Blvd. | | | | | |
| MEAN | 1.6 | 6.1 | 72 | 0.17 | 0.10 |
| MAX | 2.4 | 7.2 | 80 | 0.27 | 0.12 |
| MIN | 0.2 | 5.0 | 60 | 0.13 | 0.05 |
| MED | 1.6 | 6.1 | 73 | 0.16 | 0.10 |
| TC-2A Campbell Blvd. | | | | | |
| MEAN | 1.6 | 5.4 | 69 | 0.14 | 0.06 |
| MAX | 3.3 | 6.8 | 82 | 0.23 | 0.14 |
| MIN | 0.1 | 4.7 | 55 | 0.07 | 0.03 |
| MED | 1.3 | 5.5 | 69 | 0.13 | 0.06 |

2.58 As indicated in the 1973 Erie County Stream Survey (15) - "Mud samples from the bottoms above, at, and below the sewage treatment plant effluent contained the following taxa; Pediastrum, Gyrosigma, Stoneflies, Mayflies, Psephenus, Melosira, Closterium, Cosmarium, Cambarus, Scenedesmus, Navicula, Dictyosphaerium, Euglena, Cyclops, Campeloma, Helisoma, Pentaneura, Tendipes, Gammarus, and tubificids. The latter, tubificids were tremendously abundant with the Bloodworms (Tendipes) almost as numerous.

2.59 "Total coliform counts averaged 661 with a high pulse at the treatment plant effluent with the fecal coliforms averaging 338 and pulsating at the effluent." This count is really not excessively high but the dilution factor present in the stream is probably responsible.

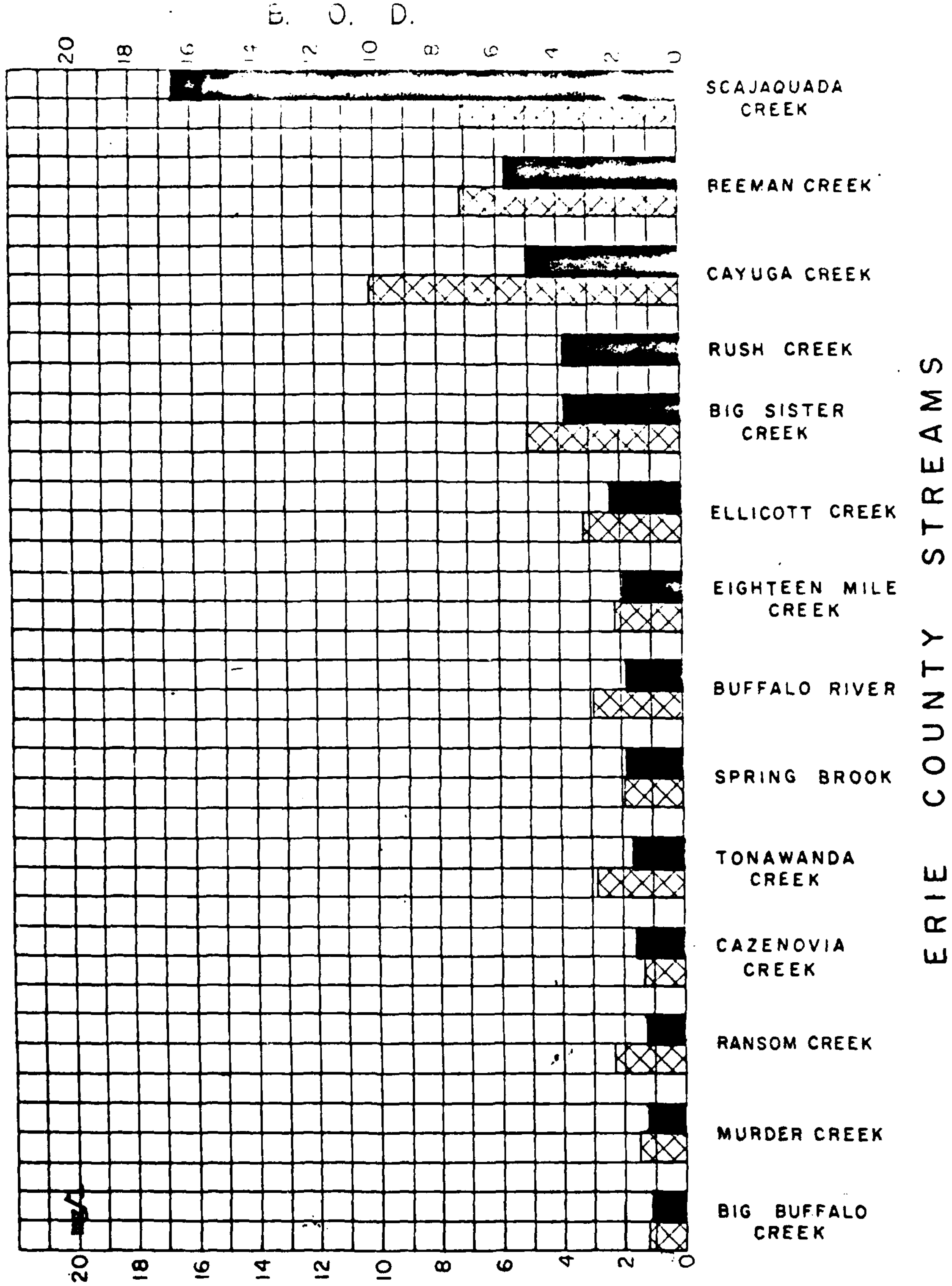
2.60 "During the 1973 season, 36 percent of the bacteriological samples taken had fecal coliform counts in excess of 300 per 100 ml. (not checked in 1972)." One hundred percent of all bottom collections in the Tonawanda Creek contained relatively large numbers of tubificids. Tendipes was the abundant insect larvae at all stations but was overly abundant at the sewage plant outfall. Combining all these data and using the combination as a pollution index, the Tonawanda was the 18th most polluted out of 20 streams studied.

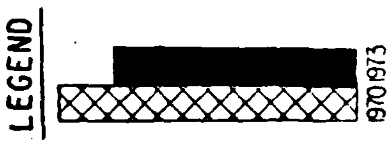



Tonawanda Creek, New York

STREAM SAMPLING STATIONS
1973 Erie County Stream Survey [15]

Plate 2.11



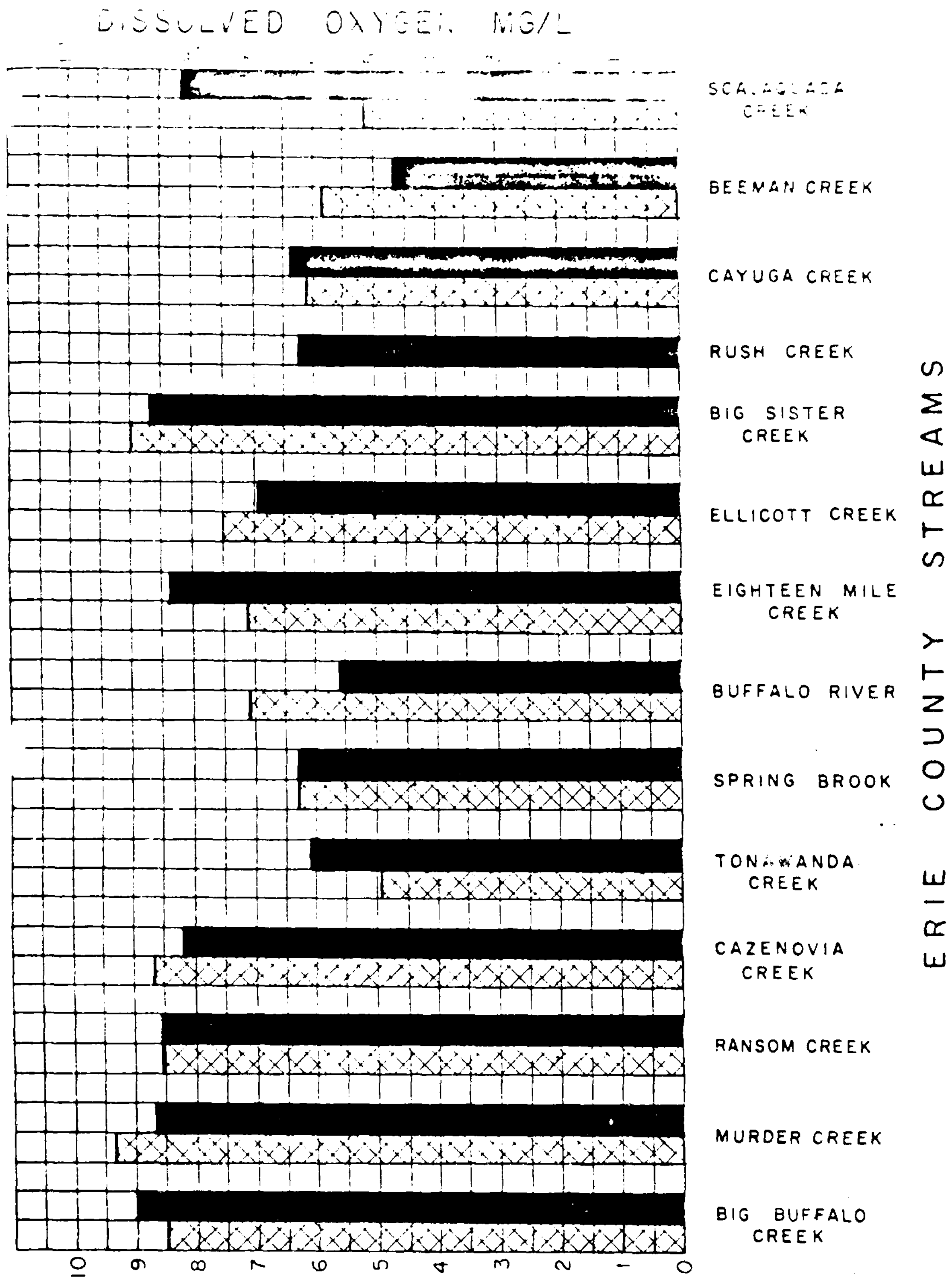




SOURCE: 1973 ERIE COUNTY STREAM SURVEY(15)

**TONAWANDA CREEK**
Erie County, New York

COMPARISON OF BIOCHEMICAL
OXYGEN DEMAND (B.O.D.) 1973 & 1970

**Plate 2.12**



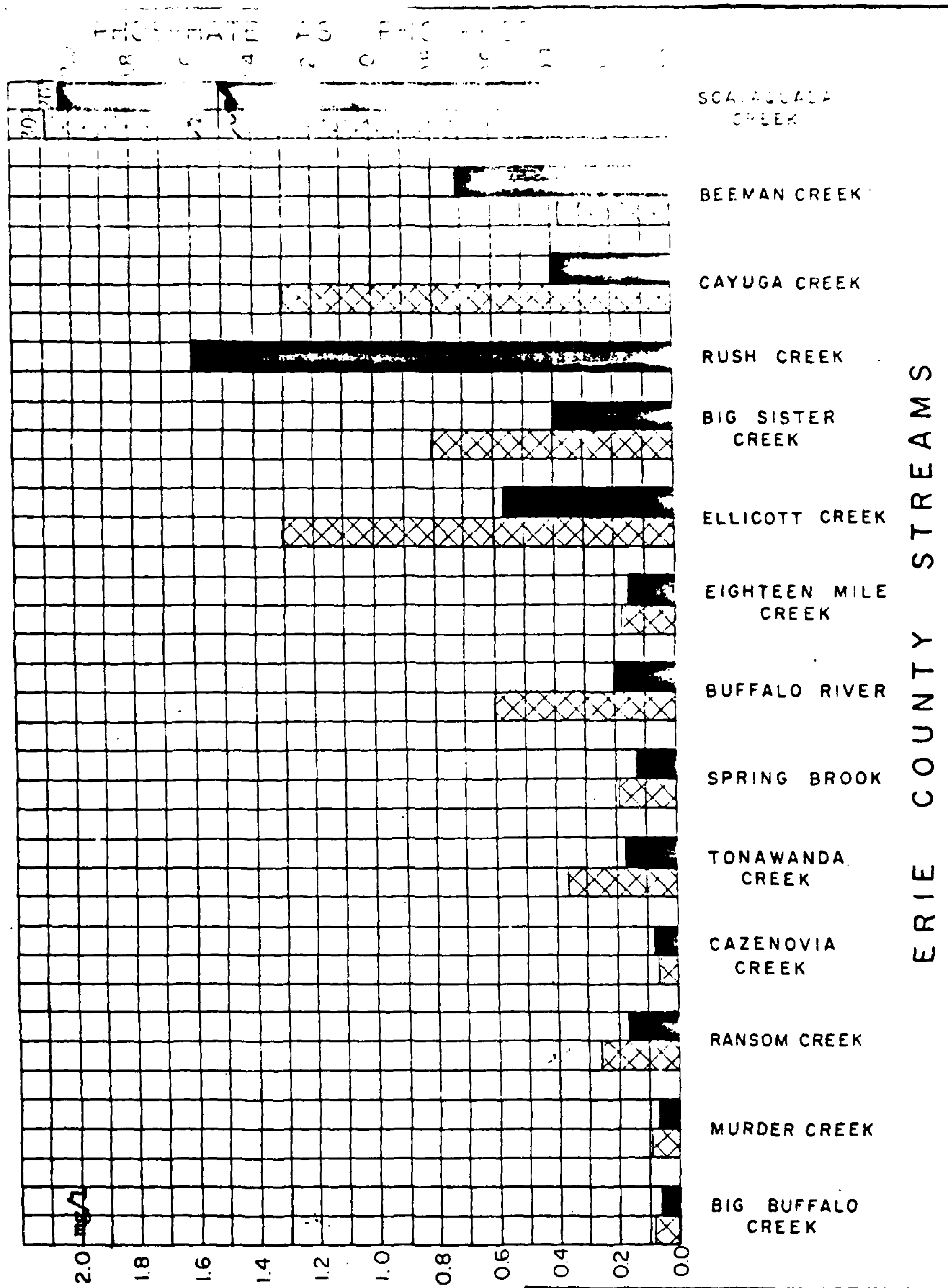


SOURCE: 1973 ERIE COUNTY STREAM SURVEY (15)

**TONAWANDA CREEK**
Erie County, New York

COMPARISON OF DISSOLVED OXYGEN 1973 AND 1970

**Plate 2.13**





SOURCE: 1973 ERIE COUNTY STREAM SURVEY(15)

**TONAWANDA CREEK**
Erie County, New York

COMPARISON OF PHOSPHATE
AS PHOSPHORUS 1973 & 1970

**Plate 2.14**

2.61 Station TC-1A (Below sewage treatment plant) - "The water here was over four feet deep, had a mud-gravel bottom with a distinct odor of sewage. Tubificids and *Tendipes* dominated the soft mud with other evidences of a zoogloeal mass present. *Vorticella* and *Carchesium* were common stalked protozoa attached to mud and plant particles. *Crenothrix* and *Sphaerotilus* were entwined about the entire mass.

2.62 TC-2 (At the sewage effluent) - "Tubificids were extremely abundant along with *Tendipes* and a pulse of both fecal and total coliforms indicated the presence of large amounts of organic wastes. *Chaoborus*, the Ghost larvae of a common midge, were abundant as a plankton very close to the mud bottom. This is a deep-water larvae usually found in large numbers where organic enrichment is great."

2.63 Station TC-2A (Above the sewage treatment plant) - "This station was as polluted as that below the effluent indicating that the entire stream contained an excess of protein matter which had not been adequately oxidized. The effluent from the treatment plant had little additional effect on the stream fauna. *Gammarus* was an important crustacean on the mud bottoms. It was interesting to note here in the samples the presence of large numbers of the ephipial eggs of *Daphnia*. Evidently the "flea" migrates somewhat up the stream from Lake Erie and the Niagara River. There is also the possibility that heavy production of *Daphnia* takes place in the lower stretches of the Tonawanda Creek."

Table 2.P - Tonawanda Creek, Erie County 1973 Stream Survey Collection Data - Coliform Bacteria[15]

| Station Number | Date | Total Coliforms/100 ml. | Fecal Coliforms/100 ml. |
|---|---|---|---|
| TC-1A | 6-20 | 790 | 50 |
| | 6-26 | 60 | 10 |
| | 7-11 | 540 | 400 |
| | 7-17 | 750 | 20 |
| | 7-24 | 440 | 310 |
| | 7-31 | 640 | 30 |
| | 8-7 | 720 | 310 |
| | 8-14 | 2000 | 510 |
| | 8-22 | 840 | 320 |
| | 8-29 | 250 | 240 |
| | 9-12 | 500 | 160 |
| | | 7530 | 2360 |
| Maximum | | 2000 | 510 |
| Minimum | | 60 | 10 |
| Median | | 640 | 240 |
| Mean | | 684 | 214 |

Table 2.P (Cont'd)

| Station Number | Date | Total Coliforms/100 ml. | Fecal Coliforms/100 ml. |
|---|---|---|---|
| TC-2 | 6-20 | 2000 | 1800 |
| | 6-26 | 430 | 110 |
| | 7-11 | 600 | 100 |
| | 7-17 | 1050 | 920 |
| | 7-24 | 340 | 60 |
| | 7-31 | 600 | 230 |
| | 8-7 | 400 | 220 |
| | 8-14 | 710 | 690 |
| | 8-22 | 750 | 570 |
| | 9-12 | 1030 | 100 |
| | | 7910 | 4800 |
| Maximum | | 2000 | 1800 |
| Minimum | | 340 | 60 |
| Median | | 655 | 225 |
| Mean | | 791 | 480 |
| TC-2A | 6-20 | 860 | 280 |
| | 6-26 | 630 | 410 |
| | 7-11 | 360 | 20 |
| | 7-17 | 410 | 290 |
| | 7-24 | 130 | 20 |
| | 7-31 | 30 | 30 |
| | 8-7 | 80 | 10 |
| | 8-14 | 100 | 10 |
| | 8-22 | 570 | 360 |
| | 9-12 | 440 | 20 |
| | | 3610 | 1450 |
| Maximum | | 860 | 410 |
| Minimum | | 30 | 10 |
| Median | | 385 | 25 |
| Mean | | 361 | 145 |

Table 2.Q - Tonawanda Creek, Erie County 1973 Stream Survey[15]
Collection Data - Benthic Organisms

| Station Number | Date | Findings | |
|---|---|---|---|
| TC-1A | 7-3-73 | *Campeloma* | 90 |
| | | *Helisoma* | 78 |
| | | *Cambarus* | 37 |
| | | *Ancylus* | 26 |
| | | *Tubifex* | 400 |
| | | *Pentaneura* | 17 |
| | | | 648 |
| | 8-8-73 | *Tubifex* | 600 |
| | | *Tendipes* | 80 |
| | | *Cyclops* | 16 |
| | | | 696 |
| | 10-1-73 | Tubificidae | 311 |
| | | *Tendipes* | 7 |
| | | | 318 |
| TC-2 | 8-8-73 | *Tubifex* | 750 |
| | | *Tendipes* | 80 |
| | | *Chaoborus* | 37 |
| | | | 867 |
| | 10-2-73 | Tubificidea | 180 |
| TC-2A | 7-6-73 | *Tubifex* | 480 |
| | | *Tendipes* | 115 |
| | | *Cyclops* | 80 |
| | | | 675 |
| | 10-1-73 | Tubificidae | 210 |
| | | *Tendipes* | 9 |
| | | | 219 |
| TC-3 | 7-6-73 | *Tendipes* | 480 |
| | | *Tubifex* | 690 |
| | | *Gammarus* | 460 |
| | | | 1630 |
| | 8-8-73 | *Tubifex* | 460 |
| | | *Tendipes* | 210 |
| | | | 670 |

2.64 A check of available computerized storet data was made to determine what existing water quality data was available on Tonawanda Creek. One sample station was done at Batavia, NY, in 1971 by the U. S. Geological Survey (see Table 2.R) with data collected on nitrates and nitrites. Additional U.S.G.S. data exists for Tonawanda Creek at Millersport, NY (see Table 2.S); sampling at this station was done from April 1974 to May 1975 and includes data on Total Lead, Mercury, Nitrogen, Percent Dissolved Oxygen, Dissolved Oxygen, Total Phosphorus and Total Zinc.

Table 2.R - Water Quality Data (16)
Tonawanda Creek at Batavia, NY
$42^\circ$59'51.0" Latitude - $78^\circ$11'20.0" Longitude
Date: 3/16/71

| Parameter | Value |
|---|---|
| Nitrate - Dissolved $NO_3$ | 3.7 Milligrams/Liter |
| Nitrite - Dissolved $NO_2$ | 0.38 Milligrams/Liter |

Table 2.S - Water Quality Data (17)
Tonawanda Creek at Millersport, NY
$43^\circ$05'10.0" Latitude - $78^\circ$41'50.2" Longitude

| Parameter | Units | Apr 74 | May 74 | June 74 | Aug 74 | Oct 74 | Dec 74 | Mar 75 | May 75 |
|---|---|---|---|---|---|---|---|---|---|
| Lead total | UG/L | 0 | 1 | 120 | 6 | 1 | 3 | 1 | 1 |
| Mercury | UG/L | <0.5 | <0.5 | < 0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Nitrogen total as N | MG/L | 0.95 | 1.2 | 1.8 | 0.67 | 2.5 | 1.7 | 1.9 | 1.0 |
| Oxygen % dissolved | | 117 | 89 | 88 | 86 | 88 | 79 | 92 | 87 |
| Oxygen dissolved | MG/L | 10.6 | 8.7 | 8.1 | 7.2 | 9.8 | 11.4 | 13.4 | 9.2 |
| Phosphorus total as P | MG/L | 0.06 | 0.09 | 0.19 | 0.09 | 0.27 | 0.09 | 0.08 | 0.09 |
| Zinc total | UG/L | 0 | 20 | 470 | 0 | 30 | 10 | 10 | 10 |

Note: UG/L - Refers to micrograms per liter.
MG/L - Refers to milligrams per liter.
< - Means "less than".

2.65 Marcus and Little (1974)[18] did some investigation of macro-invertebrates during July and August 1971 along Tonawanda Creek in Wyoming County, in the general vicinity between Attica, NY, upstream to just south of Johnsonburg, NY. Scientific names of benthic organisms identified to order, genus and when possible, species that were observed in the survey included: Decapoda (*Cambarus bartoni*); Coleoptera (*Psephenus herricki*); Megaloptera (*Corydalus cornutes*); Trichoptera (*Cheumatopsyche* sp.); Diptera (*Chironomus* sp., *Hexatoma* sp., *Tabanus* sp.) Plecoptera (*Neoperla* sp., *Paragnatina* sp., *Acroneuria ruralis*, *Neophosgenophora* sp.); Ephemeroptera (*Isonychia* sp., *Stenonema* sp. and *Tricorythodes* sp.).

2.66 A benthic sampling survey on Tonawanda Creek in the vicinity of the Batavia Reservoir Compound site, was conducted in March 1976 by the Great Lakes Laboratory, State University College at Buffalo, NY. Results of this survey are presented in Appendix E of this environmental statement.

THE HUMAN ENVIRONMENT

2.67 Land Use - The Tonawanda Creek Watershed, an area of approximately 648 square miles, is located in western New York and includes substantial portions of Erie, Niagara, Genesee and Wyoming counties in addition to a minor part of Orleans County. Plate 2.15 shows the locations of these five counties within New York State. The counties' minor civil divisions (MCD's) including towns, cities and villages in western New York, are shown on Plate 2.16.

2.68 Economic growth in the Buffalo urban area, originally stimulated by Buffalo's locational advantage as a breakbulk point for Great Lakes cargo, has induced considerable development in the western portion of the watershed. Towns and villages that were once outside Buffalo have lost their separate identity as suburbanization spread outward from the center of the city. Development of improved waterway and highway transportation networks has accelerated this expansion and transformed outlying areas, such as the towns of Amherst and Clarence, into bedroom communities for commuters. Analysis of past and present trends indicate that the process of conversion of agricultural and vacant land for residential land use is spreading to the north and east of Niagara Falls and to the northeast and east of Buffalo in Erie County. A significant factor in establishing these trends was the major highway construction of the 1960's which made these areas accessible to a large commuter population influx.

2.69 Much of the western portion of the watershed is directly in the path of this growth corridor. Vacant land in the Ellicott and Tonawanda Creek flood plains will become increasingly attractive to develop into residential subdivisions. Developments such as the new State University Campus and two planned communities in Amherst, may probably act as nodal points for future development in Amherst. Land in the northern portions of Amherst and Clarence adjacent to the creek consist of idle vacant land,

or lands actively farmed, either on a full or part-time basis. Large amounts of land have already been taken out of production in this area as a result of land speculation.

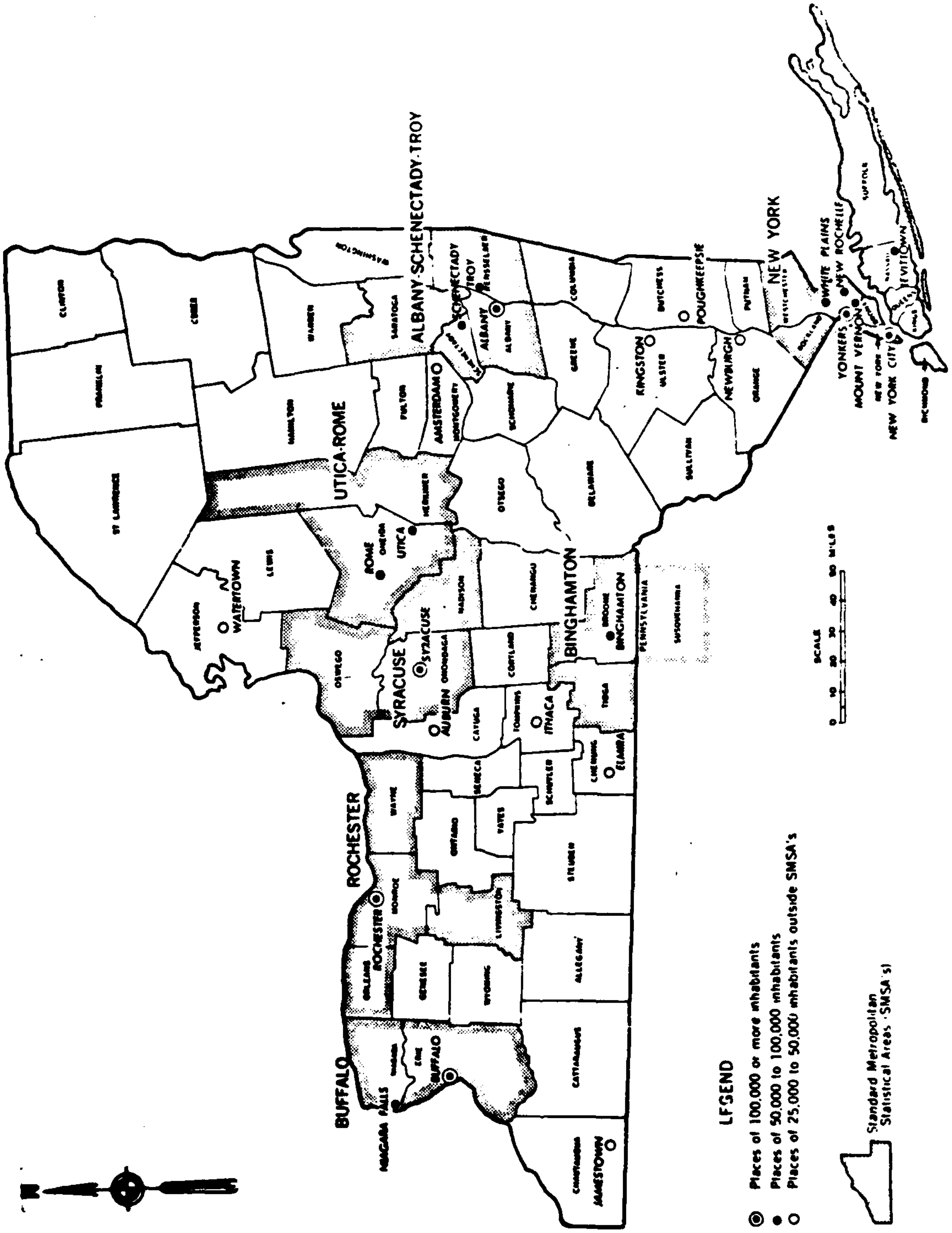
2.70 The Buffalo Metropolitan Area is the largest industrial and commercial center in upstate New York. Its highway network, large supply of skilled labor, access to raw materials, ample electric power and ready access to markets in the northeast, midwest and Canada, have all contributed to this region's economic, and in particular, its industrial development. Almost all of the development in the western portion of the watershed can be attributed to growth in the Buffalo Metropolitan area.

2.71 Remaining upstream areas of the watershed are primarily agricultural, however, the Tonawanda Indian Reservation and three extensive wildlife refuges also occupy significant areas in the center of the watershed. A secondary manufacturing, commercial and institutional growth center is Batavia, which is located in Genesee County.

2.72 Existing land use patterns in the Tonawanda Creek flood plain and adjacent areas are shown in Plate 2.17. Portions of the watershed included in Erie and Niagara Counties are coming under increasing developmental pressure to accommodate the Buffalo SMSA's demand for commercial, institutional, residential, recreation and open space land. Future estimates of the outer limits of the Buffalo urban area have been liberally estimated by regional and local planning agencies to reach the eastern boundary of the town of Clarence, about 13 miles from the center of Buffalo. An area with a 13 mile radius originating from the Buffalo Central Business District (CBD) also includes undeveloped acreage in other first and second-ring suburban towns less distant from the CBD which are also expected to experience further population growth. These towns have excellent existing and proposed transportation networks to accommodate a large, commuter-oriented population.

2.73 Agriculture is the predominant land use in Genesee and Wyoming Counties, although the manufacturing sector accounts for the largest levels of employment. Almost 286,000 acres, slightly less than 450 square miles, within the watershed are farmlands. Of this amount, 108,000 acres are designated by State planning agencies as high viability farmlands. Several agricultural districts, formed in the upper reaches, should help to maintain the future of active agriculture and discourage the conversion of productive land into nonfarm uses.

2.74 Economic and social activity upstream of the Indian Reservation is centered in the city of Batavia. Batavia's geographic location midway between Rochester and Buffalo has been a major factor in its cultural and economic dominance of the surrounding area. The city is located in a rich farm and industrial region and serves as a major center of motor freight service and a growing wholesalé distribution point. The Batavia

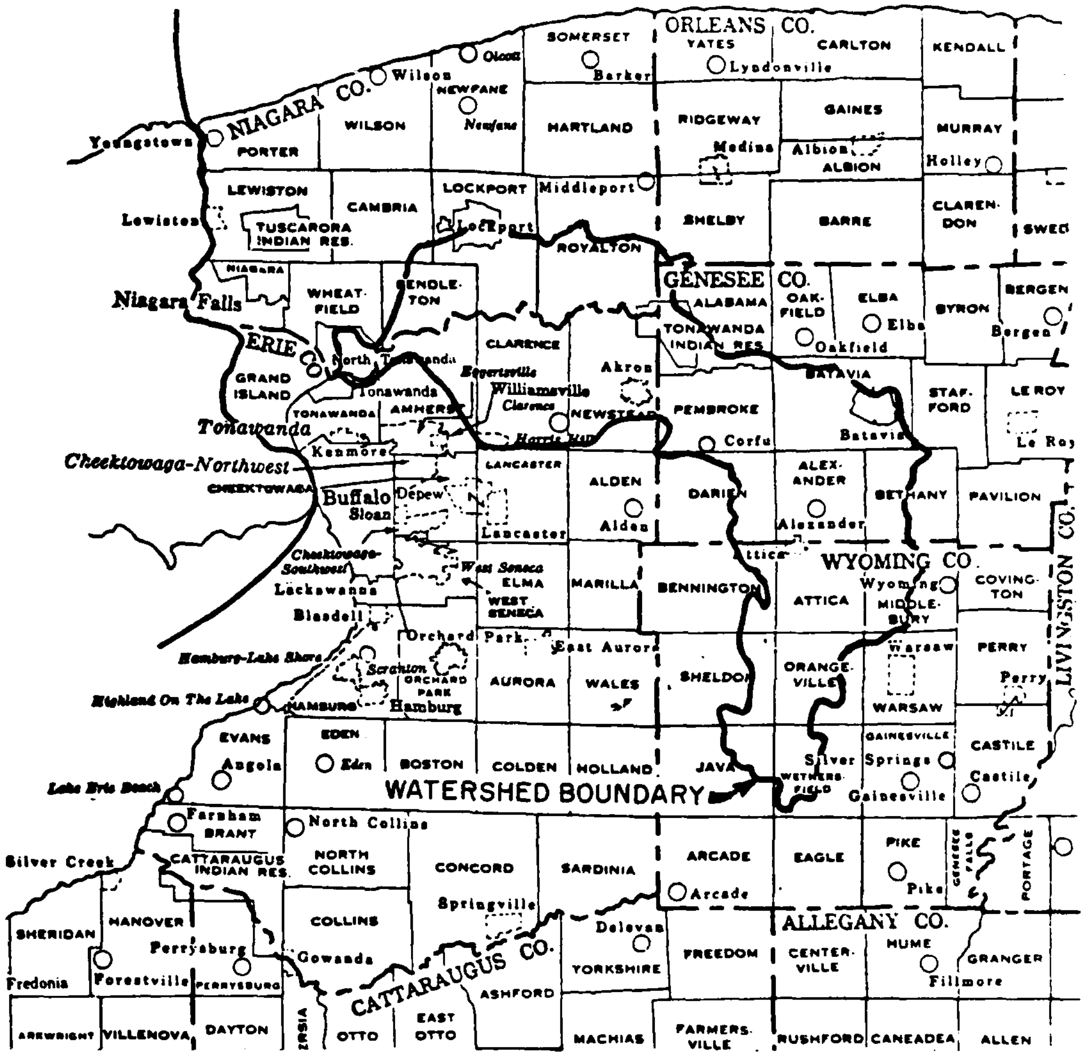



Source: U.S. Bureau of the Census, General Social and Economic Characteristics, New York, 1970 Census of Population. U.S. Gov't. Printing Office (1972)

Tonawanda Creek, New York

COUNTIES
STANDARD METROPOLITAN
STATISTICAL AREAS
AND SELECTED PLACES IN NYS

Plate 2.15

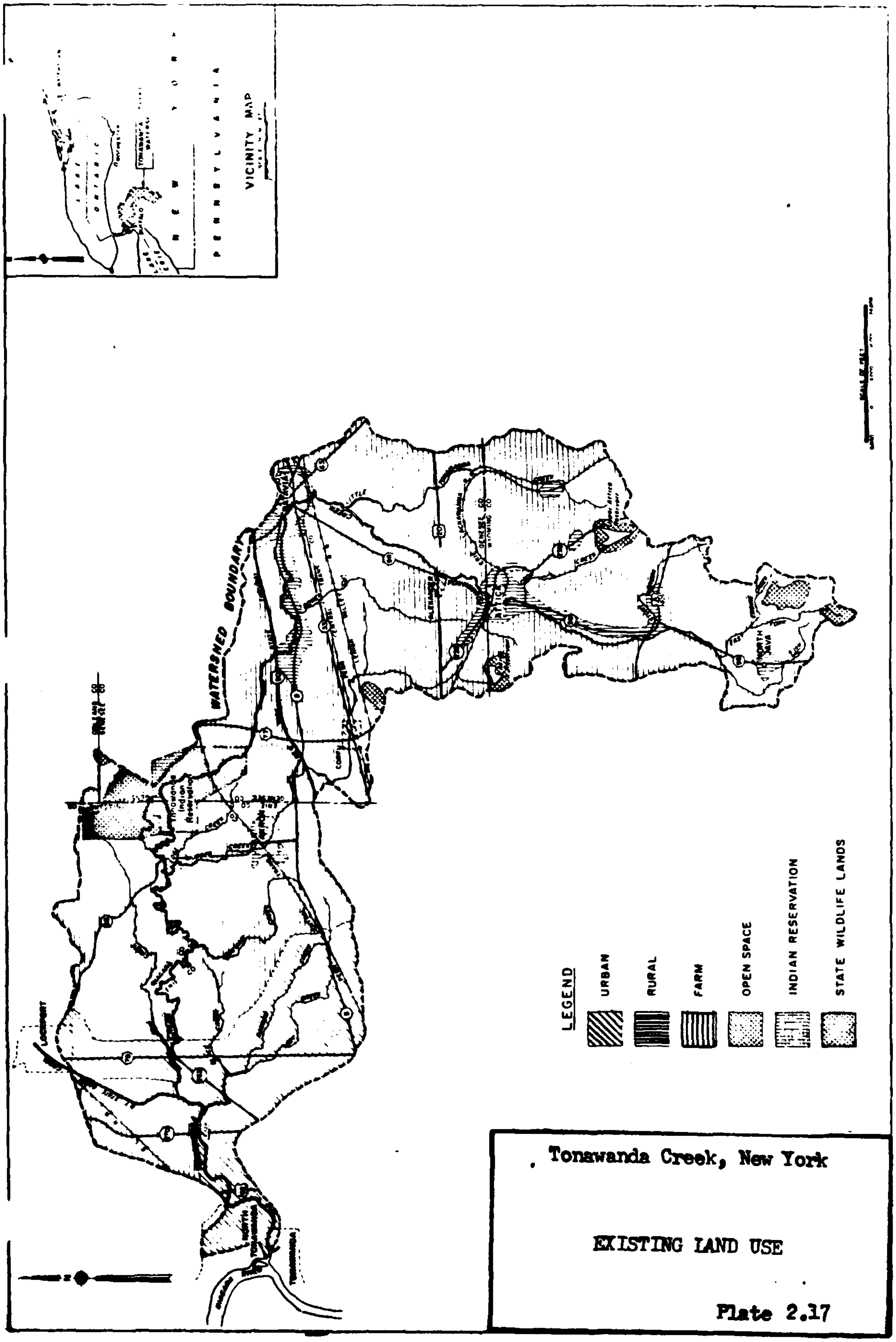



**Source:** U.S. Bureau of the Census, "Map of New York State Minor Civil Divisions". U.S. Government Printing Office (1960)

**Tonawanda Creek, New York**

**MAP OF MINOR CIVIL DIVISIONS IN WESTERN NEW YORK**

**Plate 2.16**




Tonawanda Creek, New York

EXISTING LAND USE

Plate 2.17

area is expected to continue its moderate growth rate into the future. However, this expansion will probably occur within the corporate limits of the town of Batavia. Historically, development has been centered inside the city when sufficient land was available. The growing scarcity of open areas suitable for urban development will probably result in future growth being redirected to areas outside the city limits.

2.75 Transportation - There are approximately 689 miles of improved highways in the watershed, including 50 miles of Federal highway, 239 miles of State highway, and 400 miles of county highways. In addition, the watershed contains numerous secondary city and town roads. The locations of the watershed's major highways is shown on Plate 2.18.

2.76 The main routes between Buffalo and Batavia are Interstate 90 New York State Route 5, and New York State Route 33. Between Buffalo and Niagara Falls, the main north-south routes are U. S. Route 62 and U. S. Interstate 190. Lockport and Buffalo are linked by north-south New York State Route 78. The town of Newstead is linked to Lockport via north-south New York State Route 93.

2.77 Within the Watershed, two north-south routes connect Genesee and Wyoming Counties: New York State Route 98 and 77. These routes serve the farmlands of Genesee and Wyoming Counties as the link to the city of Batavia. Route 98 runs directly to Batavia. However, traffic on New York State Route 77 must transfer to New York State Routes 63, 33, 5, or Interstate 90, to arrive at Batavia. State Route 63 also links the farmlands of Orleans County on the north to the city of Batavia. Genesee County Routes 1 and 38 also connect Batavia with farmlands to the south.

2.78 Of the major four counties within the watershed, Erie and Niagara Counties are the most densely populated and have the highest concentration of roads. Genesee and Wyoming Counties consist primarily of a farmland, therefore their road systems are not as extensive as in the downstream counties. However, the road network is adequate to serve the needs of a farm-oriented region.

2.79 The role of the watershed's highway network in the overall regional transportation system is indicated by that data presented in Table 2.T, entitled "Mode of Transportation to Work, 1970." As shown in this table, private automobiles constituted the primary mode of transit for work trips. In most of the watershed MCD's, over 80 percent of the daily work trips occurred in private automobiles. Other automotive modes, including busses and taxicabs, provide transportation to work for over three percent of the community population in the cities of Tonawanda and Lockport and in the towns of Amherst and Tonawanda. Other modes of transportation to work, including the railroad and walking, generally carry less than 10 percent of the commuting population in Erie and Niagara Counties. A significantly higher percentage of the

## Table 2.T - Mode of Transportation to Work, 1970 (19)

| | Private Automobile | | Other Automotive | | Other Modes | |
|---|---|---|---|---|---|---|
| | No. of Work Trips | % of Total Work Trips | No. of Work Trips | % of Total Work Trips | No. of Work Trips | % of Total Work Trips |
| **Erie County** | 319,614 | 78.1 | 47,890 | 11.7 | 41,996 | 10.2 |
| **Tonawanda (c)** | 7,283 | 87.3 | 266 | 3.4 | 798 | 9.3 |
| **Amherst** | 31,201 | 88.3 | 1,279 | 3.6 | 2,872 | 8.1 |
| **Clarence** | 5,869 | 91.0 | 60 | 1.0 | 523 | 8.0 |
| **Newstead** | 2,023 | 86.2 | 12 | 0.5 | 313 | 13.3 |
| **Akron (v)** | NA | NA | NA | NA | NA | NA |
| **Tonawanda** | 35,797 | 84.0 | 3,313 | 7.8 | 3,504 | 8.2 |
| **Niagara County** | 72,456 | 84.6 | 3,583 | 4.2 | 9,602 | 11.[illegible] |
| **Lockport (c)** | 8,045 | 80.2 | 727 | 7.3 | 1,263 | 12.5 |
| **N.Tonawanda(c)** | 11,799 | 87.2 | 350 | 2.6 | 1,378 | 10.2 |
| **Cambria** | 1,409 | 91.8 | 0 | 0.0 | 126 | 8.2 |
| **Lockport** | 2,715 | 90.3 | 37 | 1.2 | 256 | 8.5 |
| **Pendleton** | 1,527 | 91.0 | 0 | 0.0 | 152 | 9.0 |
| **Royalton** | 2,188 | 84.2 | 18 | 0.7 | 392 | 15.1 |
| **Wheatfield** | 3,315 | 91.1 | 13 | 0.4 | 310 | 8.5 |
| **Orleans County** | 11,386 | 83.8 | 57 | 0.4 | 2,142 | 15.8 |
| **Shelby** | 1,714 | 87.4 | 17 | 0.9 | 231 | 11.7 |
| **Genesee County** | 17,849 | 81.6 | 207 | 1.0 | 3,830 | 17.4 |
| **Batavia (c)** | 5,467 | 80.7 | 124 | 1.8 | 1,187 | 17.5 |
| **Alexander** | 934 | 92.1 | 0 | 0.0 | 80 | 7.9 |
| **Alabama** | 565 | 84.2 | 0 | 0.0 | 106 | 15.8 |
| **Bethany** | 520 | 81.0 | 0 | 0.0 | 122 | 19.0 |
| **Batavia** | 1,649 | 80.2 | 13 | 0.6 | 395 | 19.2 |
| **Darien** | 607 | 74.9 | 12 | 1.5 | 191 | 23.6 |
| **Pembroke** | 1,117 | 76.3 | 13 | 0.9 | 335 | 22.8 |
| **Stafford** | 812 | 83.5 | 0 | 0.0 | 161 | 16.5 |
| **Tonawanda I.R.** | 157 | 100.0 | 0 | 0.0 | 0 | 0.0 |

Table 2.T (Cont'd)

| | Private Automobile | | Other Automotive | | Other Modes | |
|---|---|---|---|---|---|---|
| | No. of Work Trips | % of Total Work Trips | No. of Work Trips | % of Total Work Trips | No. of Work Trips | % of Total Work Trips |
| Wyoming County | 9,971 | 75.6 | 21 | 0.2 | 3,200 | 24.2 |
| Attica | 1,115 | 81.7 | 0 | 0.0 | 250 | 18.3 |
| Attica (v) | | | | | | |
| Bennington | 677 | 77.8 | 5 | 0.6 | 188 | 21.6 |
| Java | 364 | 57.6 | 0 | 0.0 | 268 | 42.[illegible] |
| Middlebury | 407 | 74.7 | 0 | 0.0 | 138 | 25.3 |
| Orangeville | 216 | 75.3 | 0 | 0.0 | 71 | 24.7 |
| Sheldon | 525 | 71.0 | 9 | 1.2 | 205 | 27.8 |
| Wethersfield | 158 | 59.2 | 0 | 0.0 | 109 | 40.8 |

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commuting population in Genesee and Wyoming Counties use other modes of transportation particularly walking and no transportation (worked at home), due to the close proximity of agricultural sources of employment. In addition to work trip activities, the watershed's highway system also serves business vehicles used for industrial and commercial, private vehicles used for private purposes other than transit to work (such as shopping and recreational trips), and public service vehicles such as school buses, police and fire vehicles and others.

2.80 Plates 2.20 and 2.21 entitled, "Origin of Work Trips Western New York Counties 1970," provide a general indication of the volume of the work trip traffic that flows between western New York Counties and in many cases, travels over the watershed's highway network. Information on the plates indicate, in percentages, the origins of work trips for each of the ten counties in western New York. Of the counties within the Tonawanda Creek Watershed, Erie County has the highest percentage (94.8%) of internally originating work trips. About 4.2 percent of the Erie County work force lives in Niagara, Genesee, Wyoming, or Niagara Counties, and therefore must travel on highways that pass through the watershed. Commuters to Niagara County sources of employment account for 17.3 percent of those employed in the county, with Erie County generating 15.6 percent of the work trips to Niagara County. Much of this large, daily flow of traffic between Erie and Niagara Counties probably uses such highways as U. S. I90 and New York State Route 78. About 3.8 percent of those employed in Orleans County reside in either Erie, Genesee, or Wyoming Counties and therefore probably pass through the watershed to arrive at work. Genesee and Wyoming Counties draw 16.2 percent and 17.6 percent, respectively, of the people employed in each county from surrounding counties. Most of these commuters probably use highways in the watershed. Plate 2.21 indicates the source of work trips for the five counties that surround the watershed counties. Only Livingston and Monroe Counties generate a significant percentage of work trips that would require transit on watershed highways.

2.81 Public transportation in Erie and Niagara Counties, and to a lesser degree Genesee County, is of particular importance to densely populated areas where many people have no other means of transportation. Erie and Niagara Counties have a metropolitan bus service (NFTA Metro), while the city of Batavia has a city-wide service. All three areas also have a "Dial-A'Bus" system for the elderly. A public rapid transit or a more sophisticated bus system to the Buffalo urban area. The system will be primarily designed to link the Buffalo central business district with Amherst.

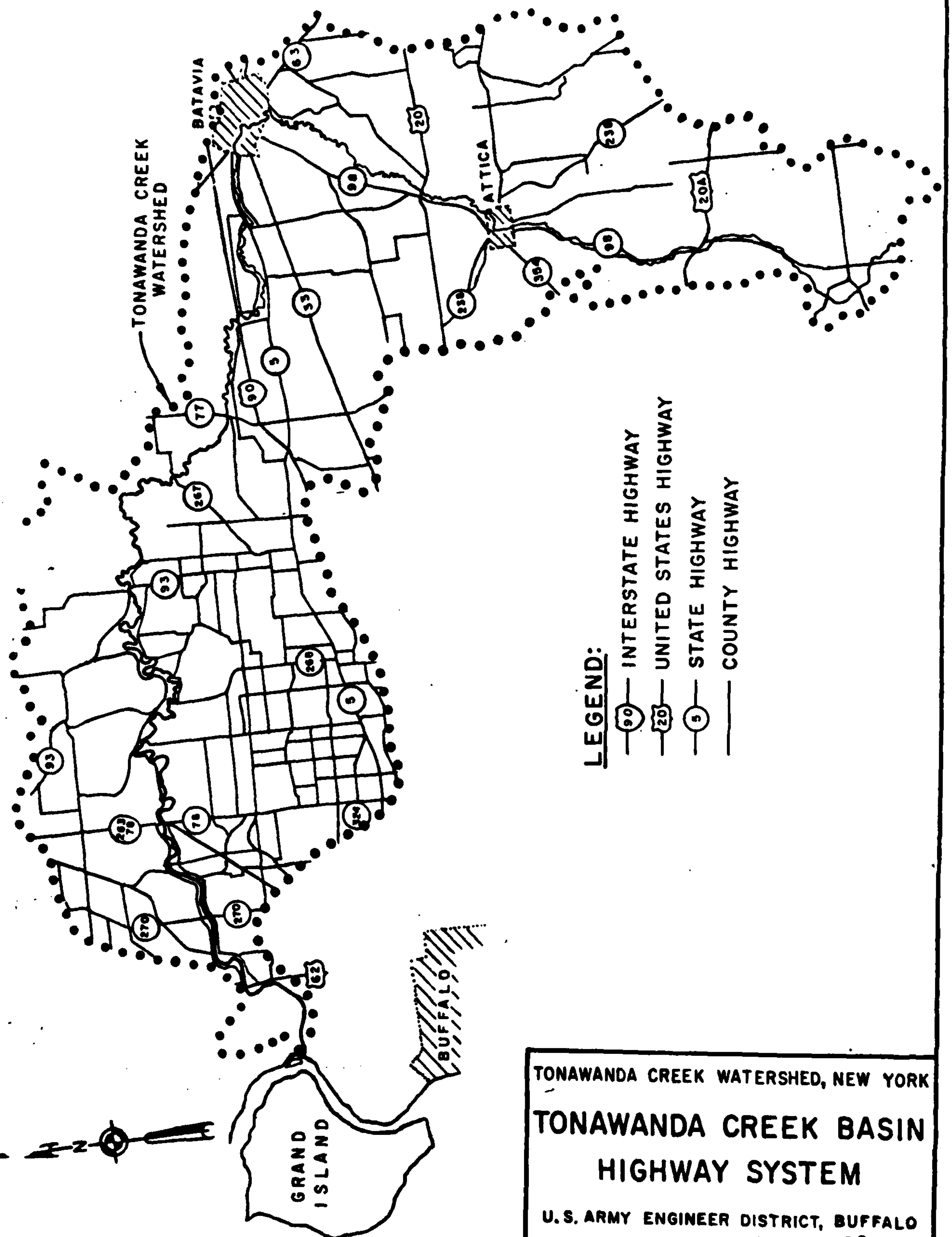
2.82 The existing rail network in the flood plain is comprised of Penn Central, Lehigh Valley, and Erie-Lackawanna trackage. Rail service is predominantly east-west oriented with major north-south linkages located in the Buffalo (Baltimore and Ohio Railroad, Norfolk and Western Railroad, and Penn Central Railroad) and Batavia (Erie-Lackawanna Railroad

and Baltimore and Ohio Railroad) areas. Plate 2.19 delineates the western New York rail network.

2.83 Rail service in western New York, as well as the entire northeast, is being reorganized under the Regional Rail Reorganization Act of 1973 (RRRA). Under this Act, the United States Railway Association has recommended a rail network built around three major integral systems: Con Rail, with Penn Central as its core and including elements of smaller railroads in reorganization; an expanded Chessie System that would extend eastward into western New York; and the Norfolk and Western combined with smaller solvent carriers operating in their existing configurations with some new trackage rights and services. Most of the existing rail network in or immediately adjacent to the flood plain was recommended to be retained by the Con Rail or Chessie networks. Two lines in the Tonawanda Creek region were not included in the Con Rail or Chessie system and were among those scheduled for discontinuance on 27 February 1976, unless a rail service continuation subsidy is provided. The two lines are the Transit Road Running Track (P.C., USRA line #100/101) and a portion of the Buffalo-Jersey City Line (L.V., USRA line #1024). The preliminary New York State Rail Plan indicated that USRA line #100/101 will not be subsidized, therefore it will, under existing plans, be abandoned. Also, USRA line #1024 will be abandoned.

2.84 In general, the Tonawanda Creek flood plain possesses adequate rail service, and the overall, long-term impact of regional rail reorganizations on western New York is not expected to be significant. There will be some dislocations and some firms may be forced out of business due to the above described abandonments. However, in the long run, the proposed organizational structure cannot only help the Region's rail carriers function more efficiently and economically than they have in the past, but also serve industry by providing a more competitive mode of transportation.

2.85 In addition to highway and rail networks, the Tonawanda Creek watershed is served by water transit on the New York State Barge Canal, which was constructed partially on the site of the former Erie Canal. The existing canal system utilizes the Tonawanda Creek channel about its lower 11.2 miles. It has a navigable depth of 12 feet, a navigable width of 75 feet, and a total width of approximately 200 feet. Water levels in the canalized section of Tonawanda Creek depend chiefly on the stages of the Niagara River at Tonawanda, which are affected by wind and barometric conditions over the Niagara River and Lake Erie. During the canal navigation season (April to December), approximately 1,100 cubic feet per second are diverted from the Niagara River easterly, via Tonawanda Creek, to the Barge Canal, to supplement the normal east-west flow from Tonawanda Creek. This water is necessary for the operation of locks and

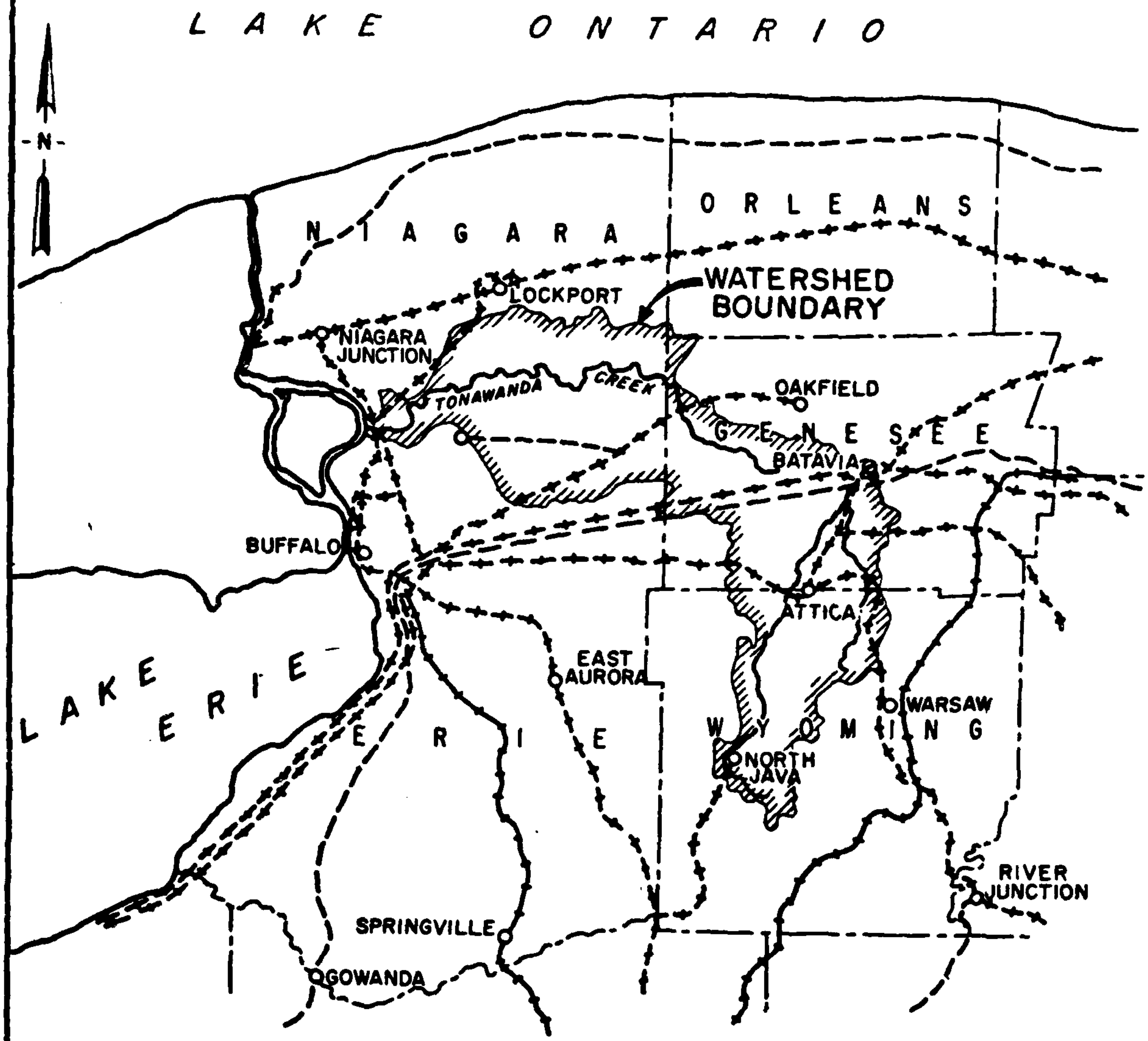



TONAWANDA CREEK WATERSHED, NEW YORK

**TONAWANDA CREEK BASIN HIGHWAY SYSTEM**

U.S. ARMY ENGINEER DISTRICT, BUFFALO

Plate 2.18




LEGEND:

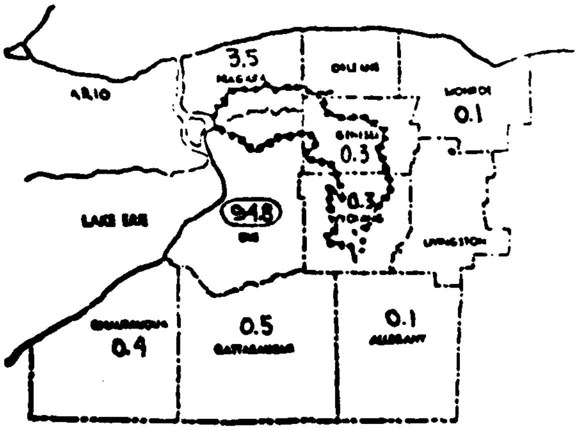
- SUBSIDIZED OR DEFERRED LINES
- OPERATIONAL LINES UNDER CON RAIL
- OPERATIONAL LINES UNDER CHESSIE

TONAWANDA CREEK WATERSHED, NEW YORK

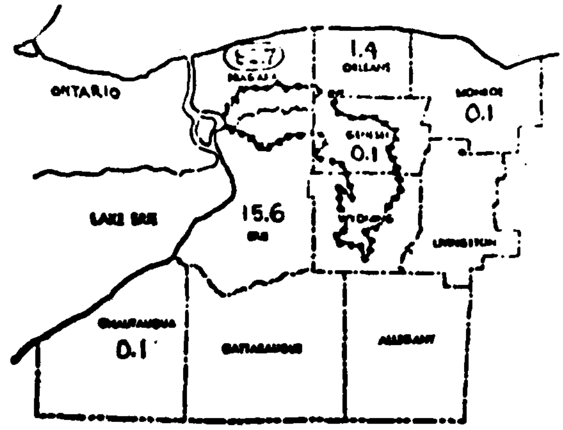
RAIL LINES IN WESTERN NEW YORK

U.S. ARMY ENGINEER DISTRICT, BUFFALO

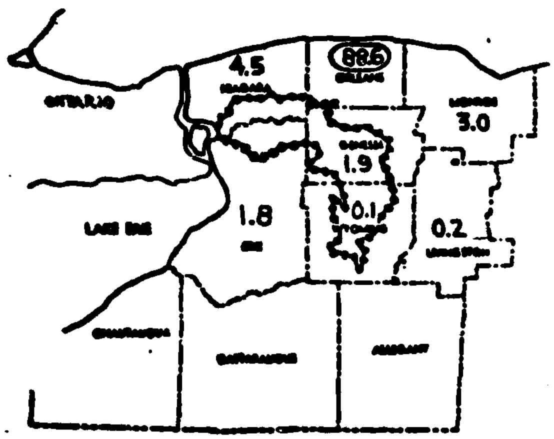
Plate 2.19



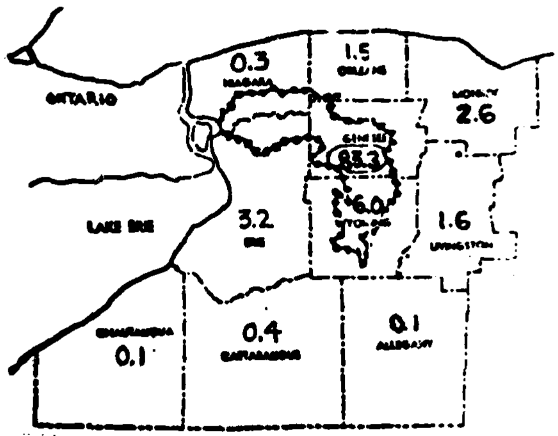

ERIE COUNTY



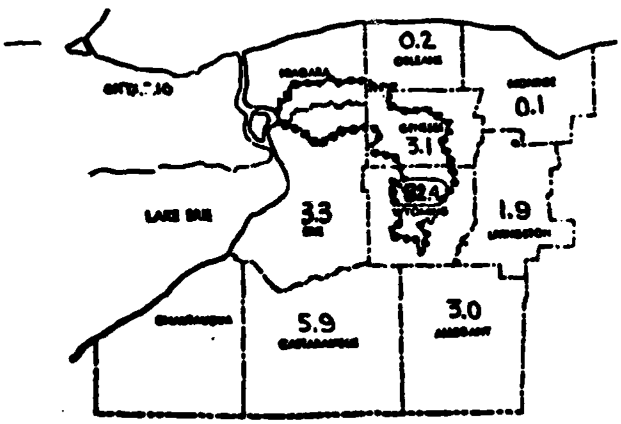

NIAGARA COUNTY




ORLEANS COUNTY




GENESEE COUNTY




WYOMING COUNTY

\- KEY -

——·——·—— County Border
•-•-•-•-•-• Tonawanda Creek Watershed Border

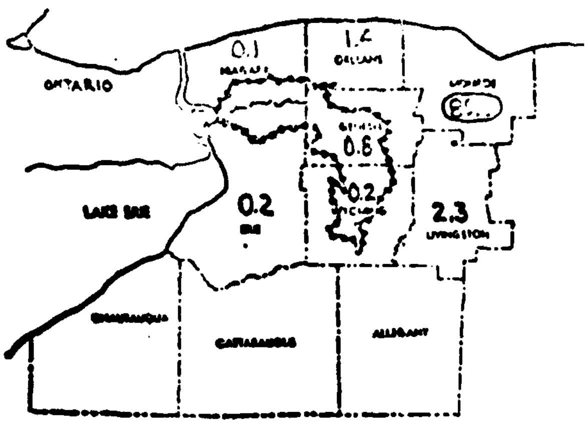
NOTE: Data in Percent

Source: 1970 Census Socio-Economic Profiles, New York State Office Planning Services, 1973

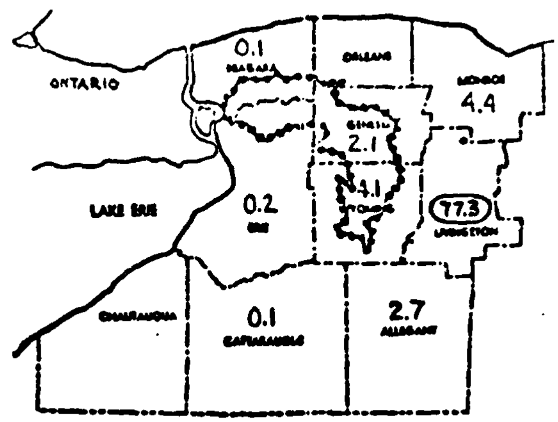
Tonawanda Creek, New York

ORIGIN OF WORK TRIPS
WESTERN NEW YORK COUNTIES 1970

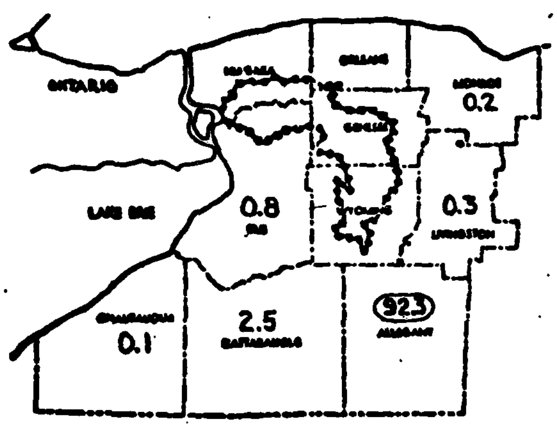
Plate 2.20



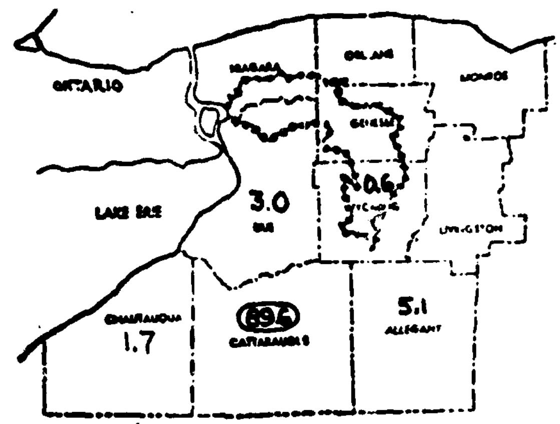

MONROE COUNTY



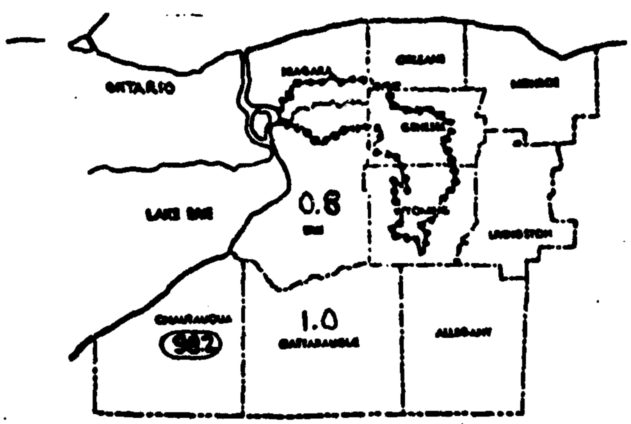

LIVINGSTON COUNTY




ALLEGANY COUNTY




CATTARAUGUS COUNTY




CHAUTAUQUA COUNTY

- KEY -

- - - - County Border
-•-•-•- Tonawanda Creek Watershed Border

Note: Data in Percent

Source: 1970 Census Socio-Economic Profiles, New York State Office Planning Services, 1973

Tonawanda Creek, New York

ORIGIN OF WORK TRIPS
WESTERN NEW YORK COUNTIES 1970

Plate 2.21

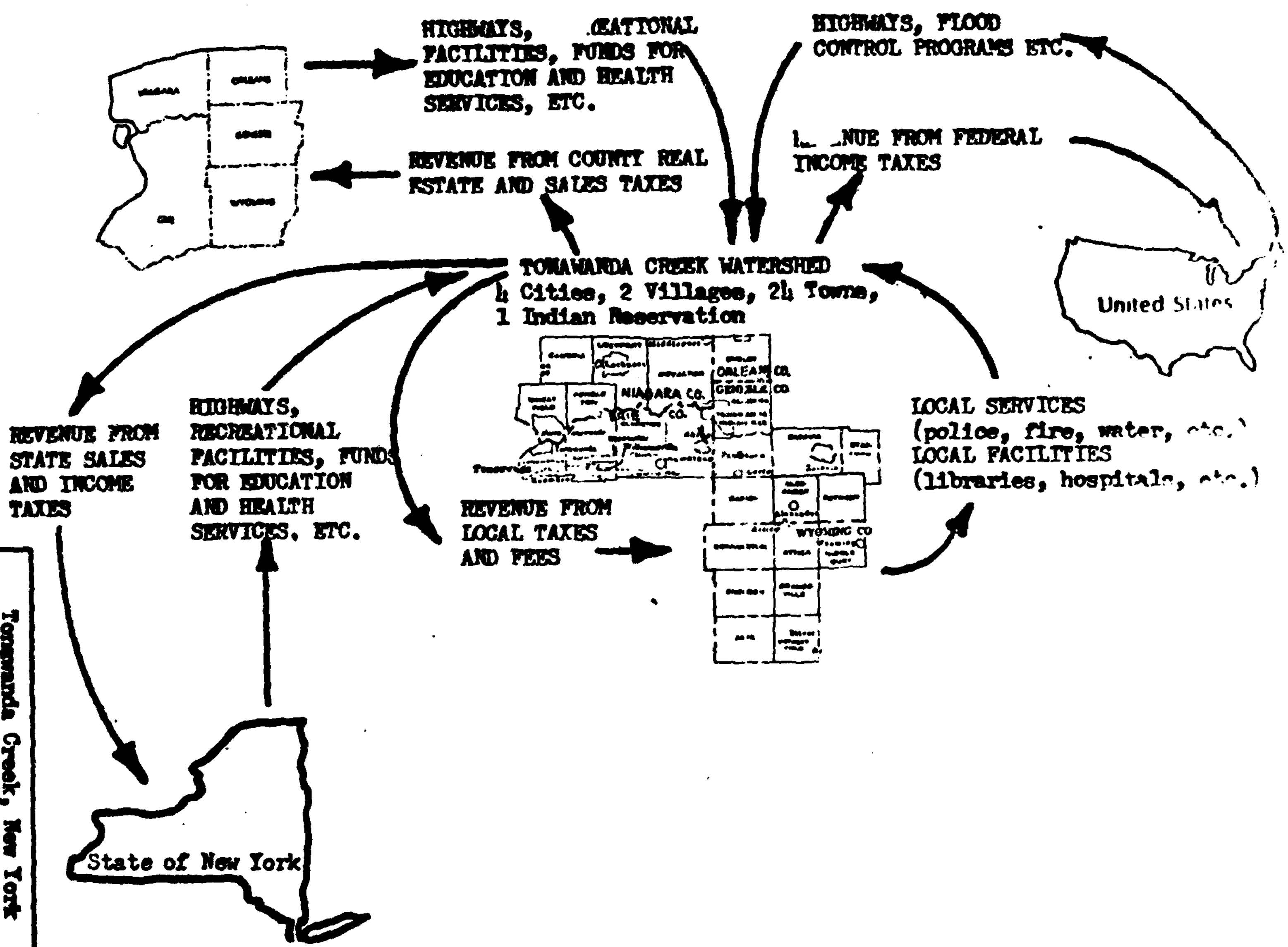
maintenance of pool levels east of Lockport. During the closed season, a Barge Canal gate at Pendleton is closed to allow all flows to flow downstream toward the Niagara River. Commercial navigation has declined considerably on the canal. Today the prime users of this facility are recreational boaters.

2.86 There are several private airports in the watershed which are used for recreational purposes. None of the facilities provide service to scheduled air carriers. Watershed airports include facilities in the towns of Amherst, Royalton, Newstead, and Batavia.

2.87 Public Services and Facilities - Public services and facilities are those activities and institutions that serve the general public and are funded through legislated taxes. The services provided by various levels of Government often interconnect with each other. Some are funded by general taxes, some by users fees, and some by specialized taxes for specific services. Five counties, twenty-four towns, four cities, two villages, and the Tonawanda Indian Reservation, are completely or partially located within the limits of the Tonawanda Creek Watershed. These minor civil divisions, together with the State and Federal Governments, supply services to, maintain facilities for, and receive revenues from private and other public entities in the watershed. The role of watershed communities in the system of public revenues, facilities, and services is shown on Plate 2.22.

2.88 Monies generated from various national and State income and corporate taxes on individuals and companies in the watershed are used to supply the region with numerous services and facilities. The Federal and State Departments of Transportation provide for the planning and construction of the watershed's primary highways. The U. S. Department of Agriculture and the New York State Department of Environmental Conservation offer agricultural improvement, land conservation, and other natural resource management programs and assistance to local municipalities and private landowners. Several wildlife and game management areas in the upstream area of the watershed are operated by State and Federal agencies (see Table 2.CC). The Corps of Engineers completed a local flood control project at Batavia in 1956. Local Governments in the watershed's minor civil divisions provide many of the day-to-day public services and facilities. The scope of available services, which varies between each political entity, generally includes educational facilities and teaching services, local law enforcement and fire protection services, waste disposal facilities, libraries, hospitals and health care services and other public systems.

2.89 The value of real property taxes in 1970 for Erie, Niagara, Genesee and Wyoming Counties was about $306.1 million. About 80 percent of the total value was generated from properties in Erie County. It is




Tonawanda Creek, New York

PUBLIC REVENUES, SERVICES AND FACILITIES

Plate 2.22

estimated that between $50 million and $100 million of the four county total was derived from properties in the Tonawanda Creek watershed. Income taxes in 1970 on residents in the watershed's MCD's probably ranged between $50 million and $100 million for State income tax and between $200 and $300 million for Federal income tax.

2.90 Industry and Business - Industrial and business activities in the Tonawanda Creek Watershed are generally concentrated in the region's urban centers, particularly in the downstream cities of Tonawanda, North Tonawanda, and Lockport, and in Batavia in the upstream section of the watershed. A list of large industrial and commercial employers with facilities in the watershed is presented in Table 2.U. A profile of the watershed's industry and business, including the number of establishments, employment, payroll, and value of output (value added by manufacture, sales, or receipts), for manufacturing, wholesale and retail trade, and service facilities is presented in Table 2.V, entitled, "Profile of Industry and Business, 1967." Leading types of industrial and business activities in the watershed are shown on Table 2.W.

2.91 The lower portion of the watershed, including the cities of Tonawanda and North Tonawanda, is located in an industrial-commercial corridor that parallels the Niagara River shoreline and stretches from the heavy industrial steel and automobile plants in Lackawanna (south of Buffalo) to the chemical and electrical power generating facilities at Niagara Falls. Industrial facilities of the Allied Chemical Corporation, the Dunlop Company, General Motors Corporation, the Occidental Petroleum Corporation, and other companies are situated within this corridor in the Tonawandas. Upstream from the Niagara River, manufacturing plants are more concentrated in the urban centers, such as Lockport and Batavia. The city of Batavia is the center of industrial activity in the upstream portion of the watershed. Over one-half of the total number of establishments, total employment, and total payroll of manufacturers in Genesee County was recorded in the city of Batavia in 1967. Business activity, including retail trade and service establishments, is more widely scattered throughout the towns in the lower watershed. Numerous shopping malls and plazas, local business districts, and commercial strip developments are located in the lower region, particularly in the Tonawandas, Lockport, and the town of Amherst. In the upstream region, retail and service establishments are more centralized in the city of Batavia and, to a lesser degree, in the village of Attica.

2.92 Agricultural output of each county in the watershed is substantial. The most recent year for which agricultural data is available (1969) ranks Erie County as the number one producer within the watershed, in terms of value of agricultural output. Erie County's agricultural output exceeded $28.8 million in 1969; Wyoming County followed

closely behind with $26.9 million. Additional details concerning the value of agricultural output for the other two counties are included in Table 2.X, "Value of Products Sold by County and by Commodity Group - 1969." Principal crops within the watershed include dairy products, field crops, vegetables, fruits and nuts and livestock other than poultry products. In the lower portion of the watershed, there is a stronger emphasis upon those agricultural commodities usually associated with truck-farm operations which serve urban centers. Genesee and Wyoming Counties are strongly oriented towards dairy farming and the production of those field crops required to support these animals.

2.93 A greater percentage of total farms in the upper reaches are commercial farms which produce at least $2,500 or more per year of agricultural commodities, whereas Niagara County has the highest proportion of farms that produce less than $2,500 of output per year (See Table 2.Y.). In contrast, the highest proportion of farms earning at least $2,500 per year are within Wyoming County. This increase in the percent of all farms earning at least $2,500 per year may be partly attributed to the decline in "gentleman farms" and part-time farm operations. Those farms in close proximity to the Buffalo Standard Metropolitan Statistical Area are more likely to be operated in a part-time or seasonal basis, whereas those farm units located further upstream are relied upon as the principle source of income by their owner-operator.

2.94 Mining operations occur on a limited basis throughout the Tonawanda Creek Watershed. The National Gypsum Corporation, which is the only gypsum firm remaining in the area, has recently placed its mining operation in a reserve status due to poor regional market conditions for gypsum-related products. Morton Salt Company operates a large brine recovery operation in Silver Springs, NY, but this company does not have any salt wells in the watershed. Hooker Chemical Corporation has several salt brine wells along Little Tonawanda Creek near Dale, NY. The salt obtained from this area is most likely used in the company's chemical plants in Niagara Falls. There are several stone quarries in the downstream portion of the watershed. The largest quarry operation in the watershed is Frontier Stone Products, which is located just south of Lockport. Quarry operators within the watershed produce stone blacktop and concrete aggregates, while a few quarries produce lime which is used in the steel making process. The largest production of natural gas in New York State now comes from Erie, Chautauqua and Cattaraugus Counties. A large natural gas field is located in southeastern Genesee outside the limits of the watershed. Small amounts of natural gas have been discovered in Wyoming County near Attica. All counties in the watershed, with the exception of Wyoming County, have sand and gravel operations. The majority of the sand and gravel is washed and screened for use in structural and paving concrete. Fill, industrial sands, and railroad ballast account for most of the remainder.

Table 2.U - Large Industrial and Commercial Employers in the Tonawanda Creek Watershed (20), (21)

| Company | Product or Service | Location |
|---|---|---|
| Adam, Meldrum & Anderson Co | department store | several locations |
| Allied Chemical Corp. | dyes and chemicals | Tonawanda |
| American Telephone & Telegraph Co (Western Electric Co., Inc., subsidiary) | wire, cable, and telephone equipment | Tonawanda |
| Associated Dry Goods Corp. (The William Hengerer Co) | department store | several locations |
| The Carborundum Co. | abrasives and felt | Wheatfield |
| Dunlop Co. Ltd. (Dunlop Tire and Rubber Corp., subsidiary) | tires and tubes | Tonawanda |
| Eaton Corp. (Construction Equipment Division) | tractor shovels and wheel-type loaders | Batavia |
| Federal-Mogul Corp. (National Grinding Wheel Division) | grinding wheels | North Tonawanda |
| General Mills, Inc. | flour milling, packaged foods, sponges and fruit drink concentrates | Tonawanda |
| General Motors Corp. (Chevrolet Motor Div.) | automotive engines, forgings and axles | Tonawanda |
| General Motors Corp (Harrison Radiator Division) | automotive radiators, heaters and air conditioner | Lockport |
| General Telephone & Electronics Corp. (GTE Sylvania, Inc., subsidiary) | television sets | Batavia |
| Graham Mfg. Co., Inc. | vacuum pumps, surface and barometric condensers and heat exchangers | Batavia |
| W. T. Grant Co. | department store | several locations |
| The Great Atlantic & Pacific Tea Co. Inc. | grocery store | several locations |
| Houdaille Industries, Inc. | machine tools and parts | Akron |
| International Paper Co. | book and bond paper | North Tonawanda |
| Loblaw, Inc. | grocery store | several locations |
| Manufacturers & Traders Trust Co. | banking and financial services | several locations |

Table 2.U (Cont'd)

| Company | Product or Service | Location |
|---|---|---|
| Marine Midland Bank-Western | banking and financial | several locations |
| Monogram Industries, Inc. (Spaulding Fibre Co., Inc., subsidiary) | laminated plastic and fibre products | Tonawanda |
| National Fuel Gas Co. | natural gas and related services | several locations |
| New York Telephone Co. | telecommunications services | several locations |
| Niagara Mohawk Power Corp. | electric utilities and related services | several locations |
| N.L. Industries (Doehler-Jarvis Division) | nonferrous foundries | Batavia |
| Occidental Petroleum Corp. (Hooker Chemical Div.) | industrial chemicals | North Tonawanda |
| Penn Central Co. | rail transportation | several locations |
| Sattler's, Inc. | department store | several locations |
| Sears, Roebuck & Co. | department store | several locations |
| The Sperry & Hutchinson Co. (Hens & Kelly Inc., subsidiary) | department store | several locations |
| Textron, Inc. (Bell Aerospace Corp., subsidiary) | aerospace systems and equipment | Wheatfield |
| Twin Fair, Inc. | department store | several locations |
| Union Carbide Corp. | cryogencies equipment, gases and chemicals | Tonawanda |
| Wallace-Murray Corp (Simonds Steel Div.) | tools and specialty tools | Lockport<br>Lockport |
| Your Host, Inc. | restaurant | several locations |

Table 2.V(20),(21) - Profile of Industry and Business, 1967

| | ERIE COUNTY | | | NIAGARA COUNTY | | | ORLEANS COUNTY | GENESEE COUNTY | | WYOMING COUNTY | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | County total | Akron | Tonawanda | County total | Lockport | N. Tonawanda | County total | County total | Batavia | County total | Attica |
| MANUFACTURERS | | | | | | | | | | | |
| No. of establishments | 1,416 | 9 | 70 | 303 | 58 | 73 | 39 | 20 | 47 | 55 | NA |
| total employment (000) | 134.1 | 0.6 | 16.3 | 42.0 | 10.0 | 5.9 | 1.9 | 7.6 | 4.7 | 3.4 | NA |
| total payroll ($ millions) | 1,009.1 | 4.5 | 133.1 | 345.7 | 78.7 | 43.1 | 10.8 | 52.3 | 31.9 | 18.1 | NA |
| value added by manufacture ($ millions) | 1,896.5 | 6.2 | 230.7 | 756.9 | 240.1 | 87.6 | 47.3 | 97.1 | 51.2 | 41.8 | NA |
| WHOLESALE TRADE | | | | | | | | | | | |
| No. of establishments | 1,791 | 5 | 39 | 224 | 52 | 42 | 38 | 78 | 42 | 26 | 2 |
| employees | 22,282 | 50 | 438 | DW | 471 | 568 | 527 | 655 | 371 | 114 | 12 |
| payroll ($000) | 152,903 | 331 | 3,108 | DW | 2,477 | 4,062 | 2,788 | 4,131 | 2,332 | 688 | 111 |
| total sales ($000) | 3,053,594 | 3,054 | 53,488 | DW | 24,610 | 35,444 | 48,532 | 58,911 | 22,732 | 9,115 | DW |
| RETAIL TRADE | | | | | | | | | | | |
| No. of establishments | 9,249 | 56 | 275 | 2,081 | 340 | 292 | 353 | 551 | 277 | 384 | 43 |
| employees | 57,246 | 132 | 1,664 | 10,493 | 2,239 | 1,268 | 1,401 | 2,431 | 1,625 | 1,083 | DW |
| payroll ($000) | 211,904 | 529 | 6,115 | 37,732 | 7,584 | 4,426 | 5,801 | 9,917 | 6,628 | 4,356 | DW |
| total sales ($000) | 1,717,947 | 5,837 | 49,941 | 330,881 | 63,401 | 45,457 | 53,944 | 96,717 | 59,583 | 45,880 | DW |
| SERVICES | | | | | | | | | | | |
| No. of establishments | 6,010 | 32 | 105 | 1,330 | 192 | 188 | 211 | 374 | 186 | 218 | 28 |
| employees | 20,261 | 18 | 184 | 2,423 | 286 | 362 | 177 | 948 | 337 | 177 | DW |
| payroll ($000) | 90,661 | 112 | 654 | 9,728 | 1,155 | 1,319 | 508 | 3,190 | 1,343 | 657 | DW |
| receipts ($000) | 286,615 | 469 | 2,901 | 36,435 | 4,491 | 5,325 | 3,119 | 13,855 | 5,353 | 3,417 | DW |

Notes: NA - Data not available.
DW - Data withheld to avoid disclosure.
Data for Attica is the total for Genesee and Wyoming Counties sections of the village.

Table 2.W (20,(21) - Leading Industries and Businesses, 1967

| | ERIE COUNTY | | | NIAGARA COUNTY | | | ORLEANS COUNTY | GENESEE COUNTY | | WYOMING COUNTY | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | County total | Akron | Tonawanda | County total | Lockport | N. Tonawanda | County total | County total | Batavia | County total | Attica |
| **MANUFACTURERS** | | | | | | | | | | | |
| first | primary metal industries (416.9) | NA | NA | chemicals and allied products (135.3) | NA | NA | food and kindred products (39.9) | fabricated metal products(14.5) | NA | electrical equip. supplies (14.0) | NA |
| second | food and kindred products(200.4) | NA | NA | stone, clay and glass products (68.3) | NA | NA | NA | machinery except electrical(13.2) | NA | NA | NA |
| third | machinery, except electrical(1942) | NA | NA | paper and allied products(58.5) | NA | NA | NA | food and kindred products(9.8) | NA | NA | NA |
| ***WHOLESALE TRADE:*** | | | | | | | | | | | |
| first | groceries, related products (571,231) | NA | NA | machinery equip. supplies (32,054) | NA | NA | NA | NA | NA | NA | NA |
| second | motor vehicles, automotive equip (524,468) | NA | NA | electrical goods (24,640) | NA | NA | NA | NA | NA | NA | NA |
| third | metals, minerals,n.e.c. (411,899) | NA | NA | groceries, related products (21,252) | NA | NA | NA | NA | NA | NA | NA |
| **RETAIL TRADE** | | | | | | | | | | | |
| first | food stores (410,995) | food stores (2,634) | food stores (14,539) | food stores (86,275) | food stores (16,842) | food stores (19,627) | automotive dealers (13,783) | food stores (18,934) | automotive dealers (11,416) | food stores (9,852) | NA |

Table 2.W (Cont'd)

| | ERIE COUNTY | | | NIAGARA COUNTY | | | ORLEANS COUNTY | GENESEE COUNTY | | WYOMING COUNTY | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | County total | Akron | Tonawanda | County total | Lockport | N. Tonawanda | County total | County total | Batavia | County total | Attica |
| second | general merchandise (299,169) | automotive dealers (1,089) | automotive dealers (8,295) | automotive dealers (58,282) | general merchandise (13,245) | automotive dealers (6,887) | food stores (13,316) | automotive dealers (17,220) | food stores (10,335) | automotive dealers (9,543) | NA |
| third | automotive dealers (291,914) | bldg mtls. hrdwr, farm equip(753) | eating, drinking places (5,417) | general merchandise stores (75,188) | automotive dealers (12,481) | eating, drinking places (3,487) | gasoline service stations (4,407) | bldg mtls. hrdwr, farm equip. (14,306) | general merchandise stores (9,283) | other retail stores (7,770) | NA |
| SERVICES first | misc. business services (104,076) | NA | NA | personal services (9,785) | NA | NA | NA | amusement, recreation (6,103) | NA | NA | NA |
| second | personal services (64,583) | NA | NA | hotels, motels, tourist courts, camps (7,760) | NA | NA | NA | personal services (2,497) | NA | NA | NA |
| third | auto repair and services (34,525) | NA | NA | auto repair and services(5,816) | NA | NA | NA | hotels, motels, tourist courts, camps (2,189) | NA | NA | NA |

Notes: Industries and business are ranking in terms of the following values:
MANUFACTURERS: Value added by manufacture in $ millions.
WHOLESALE TRADE: Total sales in $1,000. RETAIL TRADE: Total sales in $1,000.
SERVICES: Receipts in $1,000.
NA - Data not available n.e.c. - Not elsewhere classified.

Table 2.X - Value of Products Sold by County and by Commodity Group - 1969[22]
(In Thousand $)

| County | Value of Products Sold | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | Dairy Products | Poultry & Products | Other Livestock | Field Crops | Vegetables | Fruits & Nuts | Nursery & Greenhouse | Forest Products |
| Erie County | $28,016 | $12,456 | $2,682 | $2,845 | $1,187 | $3,980 | $1,397 | $3,407 | $62 |
| Percent of Total | | 44 | 10 | 10 | 4 | 14 | 5 | 12 | * |
| Niagara County | 15,988 | 4,774 | 702 | 2,023 | 1,428 | 1,097 | 4,910 | 1,025 | 18 |
| Percent of Total | | 30 | 4 | 13 | 7 | 7 | 31 | 6 | * |
| Genesee County | 19,672 | 9,719 | 1,163 | 2,101 | 3,037 | 2,985 | 39 | 605 | 44 |
| Percent of Total | | 49 | 6 | 11 | 15 | 15 | * | 3 | * |
| Wyoming County | 26,532 | 18,587 | 598 | 3,263 | 3,644 | 108 | (D) | (D) | 165 |
| Percent of Total | | 70 | 2 | 12 | 14 | * | (D) | (D) | 1 |

* Less than one percent.
(D) data withheld to avoid disclosure of information for individual farm.

Table 2.Y - Number of Farms, Acreage and Value of Land and Buildings - 1969 (22)

| County | Number of Farms | | | Acres in Farms | | Average Value of Land & Building Per Farm |
|---|---|---|---|---|---|---|
| | Total | Class 1-5 1/ | All Others 2/ | Percent of Total Area | Average Acres Per Farms | |
| Erie County | 1,680 | 983 | 697 | 33% | 132 | $54,492 |
| Niagara County | 1,654 | 731 | 923 | 50% | 104 | 39,667 |
| Genesee County | 1,029 | 618 | 411 | 61% | 191 | 52,479 |
| Wyoming County | 1,140 | 826 | 314 | 63% | 210 | 46,143 |
| New York State | 51,709 | 34,404 | 17,505 | 33% | 196 | 53,399 |

1/ Farms for which sales of farms products amounted to at least $2,500 or more per year.
2/ Total of all farms minus Classes 1-5 constitutes all others.

2.95 Employment and Income - Leading types of employment by industry in the watershed's MCD's is shown on Table 2.Z, and employment by occupation is presented in Table 2.AA. Maunufacturing industries provide the most jobs to watershed residents in all but two of the MCD's and account for at least 20 percent of the employment in every MCD. Retail trade and professional fields of employment are generally the second and third most common types of employment in the downstream section of the watershed and in Genesee County. Agricultural employment ranks in the top three types of employment in Wyoming County in every town except Attica. The leading occupations of watershed residents are operatives and craftsmen-foremen who would be employed in semi-skilled or skilled jobs in industrial or commercial facilities. Clerical or service workers generally rank second in occupational employment in the watershed's urban and suburban areas, and third in the agricultural sections. Other major occupations include professional and technical workers, which are the leading occupations in the towns of Amherst and Claence and the village of Attica, and managers and administrators. Farmers or farm managers are leading occupations in only three towns in the watershed, all of which are located in Wyoming County.

2.96 Data concerning the total number of people employed, median household and family incomes, and family incomes below $5,000 for the watershed MCD's in 1970 is presented in Table 2.BB. Significant economic changes have occurred in Western New York since 1970 levels. At the end of 1975, over 12 percent of the Buffalo SMSA's labor force was unemployed. In 1970, both the household and family median annual incomes tended to be higher in the downstream, urbanized MCD's than in the upstream, agricultural areas. Household incomes ranged from a high of $12,709 in the town of Clarence to a low of $7,350 in the town of Java. Family incomes ranged from a high of $13,919 in the town of Amherst to a low of $8,563 in the town of Wethersfield. The percentage of families with annual incomes below $5,000 ranged from 6.6 percent in the town of Clarence to 25.4 percent in the town of Java. The upstream MCD's in Genesee and Wyoming Counties tended to have a higher percentage of low-income families than the downstream areas.

Table 2.Z - Leading Types of Employment by Industry, 1970[20], [21]
(in percent)

| | First | Second | Third |
|---|---|---|---|
| Erie County | manufacturing (31.5) | professional (19.6) | retail trade (17.0) |
| Tonawanda (c) | manufacturing (40.8) | retail trade (17.7) | professional (14.2) |
| Amherst | professional (29.2) | manufacturing (21.3) | retail trade (17.2) |
| Clarence | manufacturing (28.1) | professional (20.4) | retail trade (15.9) |
| Newstead | manufacturing (39.5) | professional (17.3) | retail trade (15.0) |
| Akron (v) | manufacturing (42.4) | retail trade (18.5) | professional (18.2) |
| Tonawanda | manufacturing (27.3) | professional (21.6) | retail trade (18.8) |
| Niagara County | manufacturing (42.8) | professional (16.6) | retail trade (15.5) |
| Lockport (c) | manufacturing (45.9) | professional (17.1) | retail trade (15.7) |
| N. Tonawanda (c) | manufacturing (48.0) | retail trade (16.2) | professional (13.4) |
| Cambria | manufacturing (43.4) | professional (16.8) | retail trade (11.6) |
| Lockport | manufacturing (45.1) | retail trade (14.9) | professional (14.8) |
| Pendleton | manufacturing (43.3) | retail trade (17.1) | professional (9.8) |
| Royalton | manufacturing (46.0) | retail trade (14.4) | professional (12.1) |
| Wheatfield | manufacturing (47.8) | retail trade (16.1) | professional (12.0) |
| Orleans County | manufacturing (39.9) | professional (15.9) | retail trade (13.3) |
| Shelby | manufacturing (43.7) | retail trade (16.6) | professional (11.6) |
| Genesee County | manufacturing (36.2) | professional (16.7) | retail trade (14.6) |
| Batavia (c) | manufacturing (34.4) | professional (21.2) | retail trade (17.4) |
| Alexander | manufacturing (36.2) | professional (16.1) | retail trade (11.9) |
| Alabama | manufacturing (39.4) | retail trade (15.2) | agriculture (15.2) |
| Bethany | manufacturing (32.7) | professional (22.0) | agriculture (13.6) |
| Batavia | manufacturing (28.7) | retail trade (15.5) | professional (14.1) |
| Darien | manufacturing (28.5) | retail trade (13.2) | professional (12.7) |
| Pembroke | manufacturing (32.8) | retail trade (16.1) | professional (11.8) |
| Stafford | manufacturing (46.0) | professional (12.9) | retail trade (10.7) |
| Tonawanda I.R. | manufacturing (25.0) | professional (15.4) | retail trade (15.1) |

Table 2.Z - Leading Types of Employment by Industry, 1970[20], [21] (Cont'd)
(in percent)

| | First | Second | Third |
|---|---|---|---|
| Wyoming County | manufacturing (32.1) | professional (16.6) | retail trade (13.1) |
| Attica | manufacturing (21.8) | public administration (20.1) | professional (18.4) |
| Attica (v) | manufacturing (22.9) | professional (21.9) | public administration (18.1) |
| Bennington | manufacturing (35.2) | agriculture (15.9) | professional (14.3) |
| Java | manufacturing (22.0) | agriculture (20.7) | retail trade (16.4) |
| Middlebury | manufacturing (34.5) | agriculture (15.8) | professional (14.8) |
| Orangeville | manufacturing (26.8) | retail trade (23.5) | agriculture (18.2) |
| Sheldon | manufacturing (36.6) | agriculture (14.3) | construction (13.9) |
| Wethersfield | agriculture (34.7) | manufacturing (28.9) | professional (18.8) |

Table 2.AA - Leading Types of Employment by Occupation, 1970[20], [21]
(in percent)

| | First | Second | Third |
|---|---|---|---|
| Erie County | operatives (18.3) | craftsmen, foremen (15.3) | professional (15.3) |
| Tonawanda (c) | operatives (22.4) | clerical workers (17.8) | craftsmen, foremen (16.8) |
| Amherst | professional, technical workers (29.5) | clerical workers (16.7) | managers, administrators (14.5) |
| Clarence | professional, technical workers (22.7) | clerical workers (15.3) | craftsmen, foremen (14.7) |
| Newstead | operatives (29.0) | service workers (16.6) | craftsmen, foremen (13.6) |
| Akron (v) | operatives (30.7) | service workers (17.7) | craftsmen, foremen (12.8) |
| Tonawanda | clerical workers (21.1) | professional, technical workers (20.1) | craftsmen, foremen (14.2) |
| Niagara County | operatives (23.5) | craftsmen, foremen (16.2) | clerical workers (15.6) |
| Lockport (c) | operatives (26.0) | clerical workers (15.7) | service workers (13.8) |
| N. Tonawanda (c) | operatives (24.8) | craftsmen, foremen (17.7) | clerical workers (16.8) |
| Cambria | operatives (26.1) | craftsmen, foremen (18.1) | clerical workers (15.2) |
| Lockport | operatives (23.6) | craftsmen, foremen (17.2) | professional, technical workers (16.7) |
| Pendleton | operatives (26.1) | craftsmen, foremen (21.9) | clerical workers (11.8) |
| Royalton | operatives (28.8) | craftsmen, foremen (14.7) | professional, technical workers (11.7) |
| Wheatfield | operatives (27.6) | craftsmen, foremen (21.0) | clerical workers (14.5) |

Table 2.AA - Leading Types of Employment by Occupation, 1970[20], [21] (Cont'd)
(in percent)

| | First | Second | Third |
|---|---|---|---|
| Orleans County | operatives (26.2) | craftsmen, foremen (16.3) | service workers (12.7) |
| Shelby | operatives (29.5) | craftsmen, foremen (17.2) | clerical workers (14.3) |
| Genesee County | operatives (22.0) | craftsmen, foremen (16.2) | clerical workers (14.3) |
| Batavia (c) | operatives (19.0) | clerical workers (16.7) | service workers (15.4) |
| Alexander | operatives (24.7) | service workers (18.3) | craftsmen, foremen (14.1) |
| Alexander (v) | NA | NA | NA |
| Alabama | operatives (29.3) | craftsmen, foremen (15.3) | service workers (14.0) |
| Bethany | operatives (20.6) | service workers (14.1) | craftsmen, foremen (14.1) |
| Batavia | operatives (20.4) | craftsmen, foremen (16.7) | professional, technical workers (13.7) |
| Darien | operatives (25.8) | craftsmen, foremen (17.8) | clerical workers (12.2) |
| Pembroke | craftsmen, foremen (23.6) | operatives (20.6) | clerical workers (14.0) |
| Stafford | operatives (20.7) | craftsmen, foremen (16.7) | professional, technical workers (15.7) |
| Tonawanda | operatives (39.4) | service workers (20.6) | craftsmen, foremen (14.3) |
| Wyoming County | operatives (23.4) | craftsmen, foremen (16.4) | service workers (12.5) |
| Attica | service workers (18.8) | professional, technical workers (17.8) | operatives (14.8) |
| Attica (v) | professional, technical workers (21.7) | service workers (18.9) | craftsmen, foremen (15.4) |
| Bennington | operatives (24.9) | craftsmen, foremen (17.1) | service workers (13.7) |

Table 2.AA - Leading Types of Employment by Occupation, 1970[20], [2?] (Cont'd)
(in percent)

| | First | Second | Third |
|---|---|---|---|
| Java | operatives (20.6) | craftsmen, foremen (17.9) | farmers, farm managers (12.5) |
| Middlebury | operatives (28.9) | craftsmen, foremen (15.6) | service workers (12.5) |
| Orangeville | operatives (25.2) | service workers (15.2) | farmers, farm managers (11.9) |
| Sheldon | operatives (22.7) | craftsmen, foremen (22.5) | farmers, farm managers (12.6) |
| Wethersfield | operatives (22.6) | laborers (22.2) | clerical workers (12.6) |

Table 2.BB - Employment and Income Characteristics, 1970[20], [21]

| | Employment | | Income | | |
|---|---|---|---|---|---|
| | Civilian Labor Force | | Median Income ($) | | Percent of Families with Annual Incomes Below $5,000 |
| | Total Available | Total Employed | Households | Families | |
| Erie County | 442,867 | 422,179 | 8,769 | 10,482 | 14.6 |
| Tonawanda (c) | 8,816 | 8,484 | 9,572 | 10,521 | 13.4 |
| Amherst | 37,314 | 36,103 | 12,236 | 13,919 | 6.9 |
| Clarence | 6,864 | 6,588 | 12,709 | 13,755 | 6.6 |
| Newstead | 2,534 | 2,387 | 9,110 | 10,024 | 12.4 |
| Akron (v) | 1,198 | 1,144 | 8,507 | 9,788 | 11.4 |
| Tonawanda | 45,268 | 43,660 | 10,864 | 11,841 | 8.1 |
| Niagara County | 92,647 | 87,610 | 8,978 | 10,203 | 13.5 |
| Lockport (c) | 10,779 | 10,298 | 8,760 | 10,617 | 12.7 |
| N. Tonawanda (c) | 14,654 | 13,883 | 9,630 | 10,410 | 12.1 |
| Cambria | 1,556 | 1,463 | 9,569 | 10,050 | 11.5 |
| Lockport | 3,139 | 3,064 | 11,791 | 12,615 | 8.4 |
| Pendleton | 1,791 | 1,681 | 10,511 | 10,918 | 8.8 |
| Royalton | 2,758 | 2,659 | 9,693 | 10,629 | 12.8 |
| Wheatfield | 3,847 | 3,666 | 10,096 | 10,517 | 8.9 |
| Orleans County | 14,951 | 13,945 | 8,652 | 10,119 | 15.2 |
| Shelby | 2,186 | 2,030 | 8,290 | 9,295 | 16.7 |
| Genesee County | 23,817 | 22,548 | 8,809 | 10,005 | 14.1 |
| Batavia (c) | 7,400 | 7,016 | 7,948 | 9,856 | 14.7 |
| Alexander | 976 | 951 | 9,462 | 9,969 | 11.2 |
| Alabama | 694 | 672 | 8,535 | 9,129 | 22.4 |
| Bethany | 697 | 676 | 8,774 | 9,459 | 16.9 |
| Batavia | 2,223 | 2,144 | 8,800 | 10,048 | 17.3 |
| Darien | 915 | 866 | 8,444 | 9,681 | 13.0 |
| Pembroke | 1,597 | 1,518 | 8,980 | 9,519 | 14.9 |
| Stafford | 970 | 926 | 10,722 | 11,672 | 9.7 |
| Tonawanda I.R. | 181 | 175 | NA | NA | NA |

Table 2.BB - Employment and Income Characteristics, 1970[20], [21] (Cont'd)

| | Employment | | Income | | |
|---|---|---|---|---|---|
| | Civilian Labor Force | | Median Income ($) | | Percent of Families with Annual Incomes Below $5,000 |
| | Total Available | Total Employed | Households | Families | |
| Wyoming County | 14,126 | 13,422 | 8,195 | 9,526 | 15.8 |
| Attica | 1,561 | 1,474 | 9,075 | 9,801 | 11.7 |
| Attica (v) | 1,163 | 1,107 | 9,091 | 9,961 | 9.2 |
| Bennington | 894 | 863 | 8,538 | 9,544 | 10.2 |
| Java | 701 | 681 | 7,350 | 8,686 | 25.4 |
| Middlebury | 551 | 519 | 8,937 | 9,488 | 20.4 |
| Orangeville | 307 | 302 | 8,458 | 8,938 | 11.3 |
| Sheldon | 792 | 746 | 8,785 | 9,806 | 12.8 |
| Wethersfield | 259 | 239 | 8,333 | 8,563 | 23.0 |

2.97 Recreation - Detailed information describing recreation facilities available within the watershed was based upon a facility survey conducted by the New York State Office of Parks and Recreation Comprehensive Outdoor Recreation Plan. A subsequent report utilizing the survey results was published in 1972 and listed detailed information concerning the size activities available at each recreation site. Over sixty public and privately owned sites consisting of more than 21,500 acres were determined to lie within the limits of the Tonawanda Creek Watershed. A list of these facilities and their recreational activities is presented in Table 2.CC.

2.98 The largest concentration of recreational acreage is located in the central portion of the watershed near the Tonawanda Indian Reservation. This concentration is primarily attributed to the vast acreages associated with the Tonawanda Game Management Area (New York State) and the Iroquois Wildlife Refuge (Federal). Together these two wildlife areas account for 13,000 acres or 60 percent of the total recreational acreage available in the watershed.

2.99 A wide variety of activities are available at most of the watershed facilities. Most of the recreation areas upstream of the town of Clarence are privately owned and provide extensive facilities for camping and other activities most commonly engaged in by overnight and weekend campers (field sports, hiking and playgrounds).

2.100 Recreation facilities which are closer to higher density population centers offer a slightly different mix of activities. Golf courses are common and there are several marinas located along Tonawanda Creek which provide numerous boat launching and seasonal boat storage areas. Ellicott Creek Park, a county operated facility, is located about 3.2 miles upstream of the confluence of the creek and the Niagara River. Recreation experience in this section of the watershed tend heavily towards day-use by residents in the adjacent suburbs and cities.

Table 2.CC - Outdoor Recreation Facilities, 1972[23]

| Name of Facility | Operating Agency | Type of Enterprise | Picnicking | Swimming | Hiking | Camping | Field Games | Archery | Bicycling | Play Area | Golf | Fishing | Hunting | Horseback Riding | Boating | Water Skiing | Winter Sports | Special Activities |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Town of Amherst* | | | | | | | | | | | | | | | | | | |
| Amherst-Oakwood Golf Course | town | golf course | | | | | | | | | X | X | | | | | X | |
| Creekside Golf Course | commercial | golf course | | | | | | | | | X | | | | | | | |
| Transit Valley Country Club | private | golf course | | | | | X | | | X | X | | | | | | | |
| *Town of Clarence* | | | | | | | | | | | | | | | | | | |
| Beeman Creek Park | county | park | | | | | | | | | | | | | | | | scenic and natural areas |
| Clarence Town Park | town | park | X | X | X | | X | | | X | | X | | | | | X | natural area |
| Harris Hill Park | town | park | | | X | | X | | | X | | | | | | | | natural area |
| Thompson Park | town | park | | | X | | X | | | X | | | | | | | | natural area |
| Thunderbird Park | private | camp | | | X | X | X | | | | | | | | | | | |
| Copper Kettle Camp | commercial | camp grounds | | | | X | | | | | | | | | | | | |
| Brookfield Country Club | private | golf course | | | | | | | | | X | | | | | | | |
| William George Sporting Club | commercial | shooting preserve | | | | | | | | | | | X | | | | | |

Table 2.CC - Outdoor Recrea·

| Name of Facility | Operating Agency | Type of Enterprise | Picnicking | Swimming | Hiking | Camping | Field Games | Archery | Bicycling | Play Area | Golf | Fishing | Hunting | Horseback Riding | Boating | Water Skiing | Winter Sports | Special Activities |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| David Reisig Shooting Club | commercial | shooting preserve | | | | | | | | | | | X | | | | | |
| Loren Baker Stables | commercial | riding stable | | | | | | | | | | | | X | | | | |
| Greenwood Golf Course | commercial | golf course | | | | | | | | | X | | | | | | | |
| Swormsville Field | non-profit organization | sports field | | | | | X | | | | | | | | | | | |
| Clarence Center Fire Dept. | non-profit organization | sports field | | | | | | | | | | | | | | | X | |
| **Town of Newstead** | | | | | | | | | | | | | | | | | | |
| Akron Falls Park | county | park | | | X | | X | X | X | X | | X | | | | | X | natural and historic area |
| Russell Park | town | park | | | | | | | | | | | | | | | | |
| Wilder Park | town | park | | | | | | | | | | | | | | | | |
| Rothland Golf | commercial | golf course | | | | | | | | | X | | | | | | | |
| Dade Farms Country Club | commercial | golf course | X | | | | | | | | X | | | | | | | |
| Creekside Campground | commercial | camp grounds | | X | | X | | | | X | | X | | | | | | |
| **Town of Tonawanda** | | | | | | | | | | | | | | | | | | |
| Ellicott Creek Park | county | park | X | | X | | X | | X | X | | X | | | X | | X | scenic and natural area |

Table 2.CC - Outdoor Recrea' Facilities, 1972[23]

| Name of Facility | Operating Agency | Type of Enterprise | Picnicking | Swimming | Hiking | Camping | Field Games | Archery | Bicycling | Play Area | Golf | Fishing | Hunting | Horseback Riding | Boating | Water Skiing | Winter Sports | Special Activities |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **City of Tonawanda** | | | | | | | | | | | | | | | | | | |
| Smith Boys Marina | commercial | marina | | | | | | | | | | | | | X | | | |
| **Town of Lockport** | | | | | | | | | | | | | | | | | | |
| Knot Pipo | commercial | riding stable | | | | | | | | | | | | X | | | | |
| Rainbow Stables | commercial | riding stable | | | | | | | | | | | | X | | | | |
| **Town of Pendleton** | | | | | | | | | | | | | | | | | | |
| West Canal County Marina | county | marina | X | | | | | | | | | X | | | X | | | |
| Fish Pond | commercial | fishing area | | | | | | | | | | X | | | | | | |
| Jim's Dock | commercial | marina | | | | | | | | | | | | | X | | | |
| Millard Berry | commercial | fishing area | | | | | | | | | | X | | | | | | |
| Tonawanda Sportsmen Club | private | shooting preserve | | | | | | | | | | | X | | | | | |
| Harold A. Smith | private | shooting preserve | | | | | | | | | | | X | | | | | |
| **Town of Royalton** | | | | | | | | | | | | | | | | | | |
| Tonawanda Game Management Area | state | game management area | | | | | | | | | | | X | | | | | natural area |
| Sharpsteen Stables | commercial | riding stable | | | | | | | | | | | | X | | | | |

Table 2.CC - Outdoor Recreation Facilities, 1972[23]

| Name of Facility | Operating Agency | Type of Enterprise | Picnicking | Swimming | Hiking | Camping | Field Games | Archery | Bicycling | Play Area | Golf | Fishing | Hunting | Horseback Riding | Boating | Water Skiing | Winter Sports | Special Activities |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **City of North Tonawanda** | | | | | | | | | | | | | | | | | | |
| North Tonawanda Boat Launch | city | marina | | | | | | | | | | X | | | X | | | |
| North Tonawanda City Boat Launch | city | marina | | | | | | | | | | | | | X | | | |
| Sweeney Park | city | park | | | | X | | | | | | | | | | | | |
| Wardell Boatyard | commercial | marina | | | | | | | | | | | | | X | | | |
| Snyder Marine Sales | commercial | marina | | | | | | | | | | | | | X | | | |
| High Skipper Marine | commercial | marina | | | | | | | | | | | | | X | | | |
| **Town of Shelby** | | | | | | | | | | | | | | | | | | |
| Iroquois Wild-life Refuge | Federal | wildlife sanctuary | | | X | | | | | | | X | X | | | | | natural area |
| Tonawanda Game Management Area | state | game management area | | | | | | | | | | | X | | | | | natural area |
| **Town of Alabama** | | | | | | | | | | | | | | | | | | |
| Tonawanda Game Management Area | state | game management area | | | | | | | | | | | X | | | | | natural area |
| **Town of Bethany** | | | | | | | | | | | | | | | | | | |
| Genesee Co. Park and Forest | county | park and forest | | | | | | | | | | | | | | | | |

Table 2.CC - Outdoor Recrea‹

| Name of Facility | Operating Agency | Type of Enterprise | Recreational Activities: Picnicking | Swimming | Hiking | Camping | Field Games | Archery | Bicycling | Play Area | Golf | Fishing | Hunting | Horseback Riding | Boating | Water Skiing | Winter Sports | Special Activities |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| John A. White Game Farm | state | game farm | | | | | | | | | | | | | | | | |
| **Town of Alexander** | | | | | | | | | | | | | | | | | | |
| Batavia Cooperator Area | state | wildlife area | | | | | | | | | | | X | | | | | |
| **Town of Batavia** | | | | | | | | | | | | | | | | | | |
| Terry Hills Golf | commercial | golf course | | | | | | | | | X | | | | | | | |
| **Town of Pembroke** | | | | | | | | | | | | | | | | | | |
| Indian Falls Lake | commercial | camp grounds | | X | X | X | | | | X | | X | | | X | | | |
| Lonesome Acres Campground | commercial | camp grounds | | X | | X | | | | X | | | | | | | | |
| **City of Batavia** | | | | | | | | | | | | | | | | | | |
| McArthur Pool | city | park | | X | | | | | | | | | | | | | | |
| Batavia Golf Course | commercial | golf course | | | | | | | | | X | | | | | | | |
| Kibbe Park | city | park | X | | | | X | | | X | | | | | | | | |
| **Town of Attica** | | | | | | | | | | | | | | | | | | |
| Attica Reservoir Cooperator Fishing Area | state | fishing area | | | | | | | | | | X | | | | | | |

Table 2.CC - Outdoor Recreation Facilities, 1972[23]

| Name of Facility | Operating Agency | Type of Enterprise | Picnicking | Swimming | Hiking | Camping | Field Games | Archery | Bicycling | Play Area | Golf | Fishing | Hunting | Horseback Riding | Boating | Water Skiing | Winter Sports | Special Activities |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Town of Java | | | | | | | | | | | | | | | | | | |
| Kenlee Haven | commercial | camp grounds | | X | | X | | X | | X | | X | | | X | | | |
| James Keenan | private | sportsmen club | | | | | | | | | | | | | | | | |
| Town of Middlebury | | | | | | | | | | | | | | | | | | |
| Carlton Hill | state | multi-use area | | | X | | | | | | | | X | | | | | scenic and natural areas |
| Town of Orangeville | | | | | | | | | | | | | | | | | | |
| Hemlock Glens | commercial | camp grounds | | X | | X | | | | | | X | | X | | | | |
| Wyoming Hills | private | cabins and cottages | | X | | X | | | | | | X | | | | | | |
| Bide A Bit | commercial | camp grounds | | X | | X | | | | X | | | | | | | | scenic area |
| Wyonoco 4H | private | organized group camp | | X | X | X | | | | | | | | | | | | natural area |
| Town of Sheldon | | | | | | | | | | | | | | | | | | |
| Camp Hickory Hill | private | camp grounds | | X | X | | X | | | | | | | | | | | natural area |
| Village of Attica | | | | | | | | | | | | | | | | | | |
| Attica Village Park | village | park | | X | | | X | | | | | | | | | | | |

2.101 Demography - Table 2.DD presents selected data concerning the general demographic characteristics of the Tonawanda Creek Watershed's population. In comparing the population, household, ethnic and mobility characteristics of the watershed MDC"s, some general trends are noticable. Urban populations (residents of a central city and its surrounding suburbs) are heavily concentrated in the downstream portion of the watershed, particularly in northern Erie County. The city of Batavia and the village and town of Attica contain the only significant urban populations in the upstream portion of the watershed. Rural populations (residents living outside of a central city or its surrounding surburbs) account for 100 percent of the total population in thirteen of the seventeen watershed MCD's in Genesee and Wyoming Counties. The distinction between downstream-urban and upstream-rural populations is further illustrated by the population densities in these areas. The population per square mile in four of the six watershed MCD's in Erie County, exceeds the average population density in the respective counties (1,052.5 in Erie County and 443.1 in Niagara County). With the exception of the city of Batavia and the village and town of Attica, population densities are generally less than 100 persons per square mile in the Genesee County MCD's and less than 50 persons per square mile in the Wyoming County MCD's. Median age tends to be somewhat higher in the Erie and Niagara Counties MCD's than in the upstream areas, while average household population tends to be slightly lower in the urbanized, downstream counties.

2.102 Data concerning the ethnic composition of the watershed population indicates that the population is generally homogeneous throughout the watershed. A majority of the MCD's have less than a one percent non-white population. The only watershed MCD's with significant non-white populations are the Tonawanda Indian Reservation, which is administered by the Seneca Indian Tribe, and the town of Attica. Foreign stock populations (persons foreign born or native born of foreign or mixed parentage) account for less than 20 percent of the total populations in a majority of the MCD's, and tend to be concentrated in urbanized areas.

2.103 The level of community mobility (percent of households moving into residence 1969 - 1970) is generally less than the state level (15.4 percent) and the respective watershed county levels in each of the watershed MCD's. Relatively high mobility levels between 1969 and 1970 occurred in the town of Amherst (18.8 percent; suburb of Buffalo), the city of Lockport (17.6 percent), and the town of Cambria (20.0 percent; suburb of Lockport). Mobility was also high in the towns of Middlebury (21.7 percent), Orangeville (20.7 percent), and Wethersfield (17.5 percent). These towns border the town and village of Warsaw (the Wyoming County Seat) and have small, rural populations.

Table 2.DD - Demographic Characteristics, 1970 (20), (21), (19)

| | Population | | | | | Households | | | Ethnicity | | Community Mobility |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | % Urban | % Rural | Per Sq Mi | Medium Age | Population in households | Population per Household | Number Families | % Total Pop. non-White | % Total Pop. Foreign Stock | |
| **Erie County** | 1,113,491 | 87.9 | 12.1 | 1,052.5 | 29.2 | 1,090,152 | 3.1 | 276,621 | 9.6 | 26.2 | 16.8 |
| Tonawanda (C) | 21,898 | 100.0 | 0.0 | 5,918.4 | 28.3 | 21,836 | 3.3 | 5,581 | 0.4 | 23.6 | 15.2 |
| Amherst | 93,929 | 89.3 | 10.7 | 1,755.7 | 29.3 | 92,437 | 3.4 | 23,854 | 1.3 | 26.1 | 18.8 |
| Clarence | 18,168 | 37.9 | 62.1 | 337.7 | 28.5 | 18,033 | 3.6 | 4,531 | 0.3 | 18.5 | 13.4 |
| Newstead | 6,322 | 45.3 | 54.7 | 123.5 | 29.5 | 6,309 | 3.3 | 1,624 | 1.1 | 20.7 | 12.9 |
| Akron (V) | 2,863 | 100.0 | 0.0 | 1,590.6 | 31.6 | 2,862 | 3.1 | 762 | 1.1 | NA | NA |
| Tonawanda | 107,282 | 100.0 | 0.0 | 5,418.3 | 29.8 | 106,716 | 3.3 | 27,746 | 0.6 | 27.4 | 12.5 |
| **Niagara County** | 235,720 | 72.1 | 37.9 | 443.1 | 28.6 | 232,355 | 3.2 | 59,542 | 4.9 | 29.0 | 14.5 |
| Lockport (C) | 25,399 | 100.0 | 0.0 | 3,174.9 | 30.5 | 25,094 | 3.0 | 6,421 | 3.8 | 21.5 | 17.6 |
| N. Tonawanda (C) | 36,012 | 100.0 | 0.0 | 3,601.2 | 27.7 | 35,941 | 3.3 | 9,219 | 0.3 | 28.9 | 14.4 |
| Cambria | 4,193 | 0.0 | 100.0 | 104.8 | 25.2 | 4,111 | 3.7 | 1,009 | 0.6 | 21.5 | 20.0 |
| Lockport | 8,177 | 0.0 | 100.0 | 175.1 | 27.9 | 7,998 | 3.5 | 2,060 | 0.6 | 19.5 | 10.1 |
| Pendleton | 4,733 | 0.0 | 100.0 | 170.3 | 25.8 | 4,726 | 3.7 | 1,163 | 0.2 | 21.3 | 9.7 |
| Royalton | 7,375 | 0.0 | 100.0 | 103.9 | 27.8 | 7,239 | 3.4 | 1,803 | 1.2 | 15.7 | 8.6 |
| Wheatfield | 9,722 | 27.6 | 72.4 | 341.1 | 27.7 | 9,714 | 3.4 | 2,519 | 0.3 | 22.3 | 13.4 |

Table 2.DD - Demographic Characteristics, 1970 (20), (21), (19) (Cont'd)

| | Population | | | | | Households | | | Ethnicity | | Community Mobility |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | % Urban | % Rural | Per Sq Mi | Medium Age | Population in households | Population per Household | Number Families | % Total Pop. non-White | % Total Pop. Foreign Stock | |
| Orleans County | 37,305 | 30.9 | 69.1 | 94.2 | 28.0 | 36,756 | 3.2 | 9,230 | 5.6 | 18.0 | 14.0 |
| Shelby | 5,366 | 48,2 | 51.8 | 117.2 | 27.4 | 5,219 | 3.3 | 1,315 | 6.6 | 16.8 | 11.5 |
| Genesee County | 58,722 | 38.2 | 61.8 | 117.2 | 27.9 | 57,933 | 3.3 | 14,678 | 2.8 | 18.3 | 15.4 |
| Batavia (C) | 17,338 | 100.0 | 0.0 | 3,041.8 | 30.6 | 16,875 | 3.0 | 4,423 | 2.5 | 23.9 | 16.8 |
| Alexander | 2,351 | 0.1 | 99.9 | 64.4 | 24.3 | 2,351 | 3.7 | 563 | 0.0 | NA | 10.7 |
| Alabama | 1,872 | 0.0 | 100.0 | 44.1 | 26.6 | 1,865 | 3.5 | 466 | 0.9 | 16.8 | 12.4 |
| Bethany | 1,978 | 0.0 | 100.0 | 53.8 | 26.2 | 1,847 | 3.9 | 434 | 1.0 | 13.0 | 15.2 |
| Batavia | 5,440 | 0.0 | 100.0 | 111.7 | 28.4 | 5,408 | 3.3 | 1,397 | 1.0 | 19.1 | 13.2 |
| Darien | 2,745 | 0.0 | 100.0 | 57.0 | 26.0 | 2,713 | 3.7 | 654 | 0.7 | 15.7 | 12.8 |
| Pembroke | 3,959 | 0.0 | 100.0 | 94.0 | 27.2 | 3,953 | 3.4 | 994 | 0.8 | 15.1 | 10.5 |
| Stafford | 2,461 | 0.0 | 100.0 | 78.4 | 28.0 | 2,451 | 3.4 | 623 | 2.1 | 18.4 | 10.0 |
| Tonawanda I.R | 504 | 0.0 | 100.0 | 40.3 | NA | NA | NA | NA | 95.8 | NA | 14.8 |
| Wyoming County | 37,688 | 29.4 | 70.6 | 63.0 | 28.5 | 35,208 | 3.3 | 8,762 | 3.4 | 12.5 | 17.5 |
| Attica | 6,171 | 47.1 | 52.9 | 171.4 | 30.9 | 4,094 | 3.3 | 1.036 | 16.6 | 9.9 | 16.5 |
| Attica (V) | 2,911 | 100.0 | 0.0 | 2,079.3 | 27.6 | 2,907 | 3.1 | 748 | 0.6 | NA | NA |

Table 2.DD - Demographic Characteristics, 1970 (20), (21), (19) (Cont'd)

| | Population | | | | | Households | | | Ethnicity | | Community Mobility |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | % Urban | % Rural | Per Sq Mi | Medium Age | Population in households | Population per Household | Number Families | % Total Pop. non-White | % Total Pop. Foreign Stock | |
| Bennington | 2,544 | 0.0 | 100.0 | 46.0 | 25.3 | 2,521 | 3.8 | 592 | 0.7 | 19.0 | 15.3 |
| Java | 1,949 | 0.0 | 100.0 | 41.3 | 23.2 | 1,949 | 3.8 | 454 | 1.0 | 8.5 | 12.3 |
| Middlebury | 1,503 | 0.0 | 100.0 | 42.1 | 25.4 | 1,503 | 3.6 | 380 | 0.6 | 16.1 | 21.7 |
| Orangeville | 820 | 0.0 | 100.0 | 22.7 | 20.6 | 803 | 4.0 | 181 | 2.0 | 7.9 | 20.7 |
| Sheldon | 2,296 | 0.0 | 100.0 | 47.8 | 23.2 | 2,288 | 3.8 | 518 | 0.2 | 6.2 | 9.4 |
| Wethersfield | 674 | 0.0 | 100.0 | 18.7 | 23.1 | 674 | 3.8 | 148 | 3.3 | 9.2 | 17.5 |

2.104 Cultural Resources - The National Register of Historic Places and the New York State Inventory of historic and archaeological sites list over forty cultural resource sites that are located within the watershed's MCD's. Twenty-three of the identified sites are historic structures located in the city of Lockport and nine historic areas are located in the city of Batavia. Other historic structures are scattered throughout the region. Only two identified archeological sites are located in the watershed MCD's: the Spirit Lake site in the town of Alabama and Shelby Fort in the town of Shelby. A list of the historic and archaeological sites identified in the National Register and the State inventory is presented in Table 2.EE. One historic feature that is not listed in either the National Register or the State inventory is the Erie Canal. In 1825, the State of New York completed the Erie Canal (later modified and renamed the New York State Barge Canal), to provide a navigable water route from Lake Erie to the Atlantic Ocean. The Canal and Tonawanda Creek channel are one and the same from the mouth of the Creek on the Niagara River to near the hamlet of Pendleton, a distance of 12-1/2 miles. Near Pendleton the canal was constructed on a northerly course to pass the Tonawanda Creek Watershed in the city of Lockport.

2.105 A reconnaissance level cultural resource literature search and records review of the Tonawanda Creek Watershed was recently conducted by Dr. Warren Barbour and Ms. Kathleen Miller of the Department of Anthropology, State University of New York at Buffalo. A summary of cultural resource findings is given in their report dated 21 April 1976, which is included in Appendix F of this environmental statement.

2.106 Aesthetics The aesthetic environments of Tonawanda Creek vary significantly over the length of the creek. The aesthetic characteristics of the creek are generally dominated by surrounding land uses and their particular aesthetic features. The creek itself is devoid of significant waterfalls and gorge areas. Land around the creek's headwaters in Wyoming County consists primarily of farm fields and various types of natural open-space (grass fields, brushland, wooded areas). The major man-made features visible in the upstream section are farm buildings, residences, roads, and rail lines. Much of this section consists of farm buildings, residences, roads, and rail lines. This type of visual setting is also evident in Genesee County outside of the developments at Attica, Alexander, and Batavia. At Attica and Alexander, only a few hundred feet of the creek pass through the communities' small business districts. However, the creek meanders for about a mile through residential, commercial and industrial areas of Batavia. Below Batavia, the general mix of agricultural and natural environments is again dominant, and views along the creek encompass adjacent fields, bankside trees and brush, and the creek's water surface. The level of man-made developments near the creek

Table 2.EE - Identified Historic and Archaeological Sites, Tonawanda Creek Watershed

| Site | MCD Location | Cultural Feature | Source |
|---|---|---|---|
| New York Central Railroad Station | City of Tonawanda | Historic Structure | NYSPOR |
| Clark Twinn House | Village of Akron | Historic Structure | NYSOPR |
| Spirit Lake Site | Town of Alabama | Archaeological Structure | NYSOPR |
| Fly Parker House | Town of Alabama | Historic Structure | NYSOPR |
| East Main Street Bldg. | City of Batavia | Historic Dist. | NYSOPR |
| City Hall | City of Batavia | Historic Structure | NYSOPR |
| Mix House | City of Batavia | Historic Structure | NYSOPR |
| Batavia Club | City of Batavia | Historic Structure | NRHP & NYSOPR |
| Genesee County Courthouse | City of Batavia | Historic Struc. | NRHP & NYSOPR |
| Richmnord Mansion | City of Batavia | Historic Struc. | NYSOPR |
| 312 East Main Street | City of Batavia | Historic Struc. | NYSOPR |
| Governor Hunt House | City of Lockport | Historic Struc. | NYSOPR |
| Kelsey Tavern | City of Lockport | Historic Struc. | NYSOPR |
| Hennepin Hall | City of Lockport | Historic Struc. | NYSOPR |
| Frontier House | City of Lockport | Historic Struc. | NYSOPR |
| Kenom House | City of Lockport | Historic Struc. | NYSOPR |
| Colonel Bond House | City of Lockport | Historic Struc. | NYSOPR |

Table 2.EE - Identified Historic and Archaeological Sites, Tonawanda Creek Watershed

| Site | MCD Location | Cultural Feature | Source |
|---|---|---|---|
| Merrit House | City of Lockport | Historic Struc. | NYSOPR |
| St. Josephs Academy | City of Lockport | Historic Struc. | NYSOPR |
| Second Presbyterian Church | City of Lockport | Historic Struc. | NYSOPR |
| Hitchings House | City of Lockport | Historic Struc. | NYSOPR |
| Barge Canal Locks | City of Lockport | Historic Struc. | NYSOPR |
| YMCA Building | City of Lockport | Historic Struc. | NYSOPR |
| Cressey House | City of Lockport | Historic Struc. | NYSOPR |
| Western Block Warehouse | City of Lockport | Historic Struc. | NYSOPR |
| Dayton House | City of Lockport | Historic Struc. | NYSOPR |
| Dr. Skinner House | City of Lockport | Historic Struc. | NYSOPR |
| Spalding House | City of Lockport | Historic Struc. | NYSOPR |
| Vine Street School | City of Lockport | Historic Struc. | NYSOPR |
| Lockport Bank | City of Lockport | Historic Struc. | NYSOPR |
| Christ Church | City of Lockport | Historic Struc. | NYSOPR |
| Jackson Block | City of Lockport | Historic Struc. | NYSOPR |
| Shelby Fort | Town of Shelby | Archaeological | NYSOPR |
| Folsom House | Town of Bennington | Historic Struc. | NYSOPR |
| Smith House | Town of Java | Historic Struc. | NYSOPR |
| Moses Rowe Tavern | Town of Middlebury | Historic Struc. | NYSOPR |

Table 2.EE - Identified Historic and Archaeological Sites, Tonawanda Creek Watershed

| Site | MCD Location | Cultural Feature | Source |
|---|---|---|---|
| Doolittle House | Town of Wetherfield | Historic Struc. | NYSOPR |
| Alexander Classical School | Town of Alexander | Historic Struc. | NRHP |
| Holland Land Office | City of Batavia | Historic Struc. | NRHP |
| Richmond Memorial Library | City of Batavia | Historic Struc. | NRHP |
| Lowertown Historic District | City of Lockport | Historic Dist. | NRHP |
| Benjamin C. Moore Mill (Lockport City Hall; Hally Water Works) | City of Lockport | Historic Struc. | NRHP |

Sources: NYSOPR - *New York State Office of Parks and Recreation*, "Historic and Archaeological Sites Inventory," Albany: 1967-1968.

NRHP - "National Register of Historic Places," 4 February 1975 Federal Register and monthly supplements.

gradually increases downstream as the creek approaches the Niagara River. Natural settings are replaced by numerous highways, commercial zones, and residential complexes that sporadically appear in views of the creek. Recreational areas, such as Ellicott Creek Park in the town of Tonawanda, have preserved some of the creek's natural features in the downstream area.

2.107 Future Environments - In general, future land use patterns in the Tonawanda Creek Watershed are not expected to undergo significant changes through the early decades of the twenty-first century. The greatest potential future users of the Tonawanda Creek flood plain are farmers who plant a variety of grains and forage crops for consumption by the watershed's dairy operations. However, no net demand for agricultural land is expected since the general trend of decreasing farming units of larger size is anticipated to continue in the foreseeable future. Residential development is expected to move into the flood plain areas over time, particularly in the downstream areas in the vicinity of the Ransom Oaks development in the northern part of Amherst. Only a minimal amount of commercial development is expected in the future. Commercial growth will probably be limited to small, concentrated plazas and local business districts developed in conjunction with downstream residential areas. Provision has been made for a planned industrial park in Amherst along Tonawanda Creek. Actual construction of this park would be primarily contingent upon the proposed Lockport Expressway, the development of which is uncertain at this time. No encroachment within the 100-year flood outline is expected to occur in either the city or town of Batavia due to large amounts of undeveloped land available in the northeastern portion of the city and large areas contiguous to the city limits in the town of Batavia. Residential development expected to occur outside the city will be tied into city water and waste treatment facilities. Local planning officials have indicated a desire to direct future industrial growth into the new industrial park located south of Pearl Street. Completion of an urban renewal project in the Batavia central business district should provide ample space for increased levels of commercial activity expected in the future. The potential recreation value of open-space corridors along Tonawanda Creek and its major tributaries has been recognized by the Erie-Niagara Counties Regional Planning Board, which has urged the incorporation of these riverine areas into the region's recreation plan. However, inland streams offer limited water recreational possibilities because of their small size and low sustained flows during the summer. The few inland lakes (Divers Lake and Phelps Pond in the town of Alabama) and scattered, small reservoirs offer limited water-oriented recreational possibilities because of their small size and inaccessibility for public use.

2.108 Historic and projected population levels in the counties and MCD's within the Tonawanda Creek Watershed are presented in

Table 2.FF. The projections listed in the table were developed by the New York State Office of Planning Services in 1974. The watershed population counts and percentages of each county's population in the watershed, as shown in the table, are greater than the actual number of people residing in the watershed due to the inclusion of MCD's that are only partially in the watershed limits. However, the trends of population growth are considered representative of the watershed in general. Population levels in Erie County are not expected to significantly increase through the year 2000. The northern part of the county in the Tonawanda Creek Watershed is expected to grow at a greater rate than the county, and about 30 percent of the county's total population is expected to be located in the watershed MCD's by 2000, the MCD's in the watershed will show population increases. About half of the county's residents will reside in watershed MCD's by 2000. Most of this growth will probably occur in Lockport and its suburban communities and in the development corridor between the town of Amherst in Erie County and Lockport. Very little of the watershed's population is located in Oleans County, which is beyond the creek flood plain. Both Genesee and Wyoming Counties are expected to experience about a 50 percent increase in population by the year 2000. In most cases, the rate of population increases in each county's MCD's in the watershed will be less than the individual county growth rates. The proportion of each county's population in watershed MCD's is expected to remain at about 65 percent in Genesee County and about 40 percent in Wyoming County. The total population of all MCD's in the Tonawanda Creek watershed is expected to grow to about 576,000 by 2000, for a total increase of about 40 percent over the area's 1970 population. The State's projection of about 1,493,000 residents in the Buffalo SMSA (Erie and Niagara Counties) by 2000 is slightly above the 1,419,600 population level for that year projected in the U.S. Water Resources Council's Series E OBERS Projections, dated April 1974. The OBERS Projections have taken into consideration recent, national economic conditions and are therefore more conservative than the State's projections. While the OBERS Projections probably reflect a more accurate picture of overall future population levels, the general distribution trends of the watershed's population will probably occur as indicated by the State's projections on Table 2.FF.

2.109 Series E OBERS Projections of per capita income, total personnal income, and total employment for the upstream and downstream regions of the Tonawanda Creek Watershed are presented in Table 2.GG. Per capita income is expected to increase at about the same rate in both regions, with per capita income remaining slightly higher in the downstream area than in the upstream area. Total personal income is also expected to grow at about the same rate in both regions. Total employment is

expected to increase in both regions throughout the next fifty years. However, in view of the recent decline in the local economy and the growing importance of the trade and commercial sectors, future levels of manufacturing employment in the downstream region (Erie and Niagara County) will probably remain constant. Manufacturing employment in the upstream region will probably continue to increase and account for about 30 percent of the area's jobs.

2.110 The New York State Office of Parks and Recreation has projected an increase in recreating populations in the watershed counties through 1990. Projections for each county's picnicking, camping and hunting populations are presented in Table 2.HH. In general, the upstream counties recreating populations are expected to increase at about twice the rate of the downstream counties. Total recreating populations for each activity will remain highest in Erie County.

Table 2.FF - Population, 1950 - 2000[24]

| | Erie County | | | Niagara County | | | Orleans County | | | Genesee County | | | Wyoming County | | | Tonawanda Co. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | County Total | County MCD's in Watershed | % of Co. Tot. in Watershed | County Total | County MCD' in Watershed | % of Co. Tot. in Watershed | County Total | County MCD's in Watershed | % of Co. Tot. in Watershed | County Total | County MCD's in Watershed | % of Co. Tot. in Watershed | County Total | County MCD's in Watershed | % of Co. Tot. in Watershed | Watershed (Total) |
| 1950 | 899,238 | 114,615 | 12.8 | 189,992 | 67,987 | 35.8 | 29,832 | 4,482 | 15.0 | 47,584 | 31,978 | 67.2 | 32,822 | 12,865 | 39.2 | 231,927 |
| 1960 | 1,064,688 | 208,522 | 19.6 | 242,269 | 89,535 | 37.0 | 34,159 | 5,051 | 14.8 | 53,994 | 36,291 | 67.2 | 34,793 | 14,118 | 40.6 | 353,517 |
| % Change | +18.4 | +8.9 | - | +27.5 | +31.7 | - | +14.5 | +12.7 | - | +13.5 | +13.5 | - | +6.0 | +9.7 | - | +52.4 |
| 1970 | 1,113,991 | 247,599 | 22.2 | 235,720 | 95,611 | 40.6 | 37,305 | 5,366 | 14.4 | 58,722 | 38,632 | 65.8 | 37,688 | 15,957 | 42.3 | 403,165 |
| % Change | +4.6 | +18.7 | - | -2.7 | +6.8 | - | +9.2 | +6.2 | - | +8.8 | +6.5 | - | +8.3 | +13.0 | - | +14.0 |
| 1975 | 1,123,400 | 271,865 | 24.2 | 236,385 | 100,830 | 42.7 | 38,191 | [illegible],544 | 14.5 | 61,436 | 40,141 | 65.3 | 39,623 | 16,741 | 42.3 | 435,121 |
| % Change | +0.9 | +9.8 | - | +0.3 | +5.5 | - | +2.4 | +3.3 | - | +4.6 | +3.9 | - | +5.1 | +4.9 | - | +7.3 |
| 1980 | 1,147,221 | 293,875 | 25.6 | 238,471 | 106,175 | 44.5 | 39,775 | [illegible],721 | 14.4 | 64,464 | 41,810 | 64.9 | 42,021 | 17,525 | 41.7 | 465,106 |
| % Change | +2.1 | +8.1 | - | +0.9 | +5.3 | - | +4.2 | +3.2 | - | +4.9 | +4.2 | - | +6.1 | +4.7 | - | +6.9 |
| 1985 | 1,181,459 | 318,365 | 27.0 | 240,238 | 111,705 | 46.5 | 41,613 | [illegible],054 | 14.6 | 67,818 | 43,686 | 64.4 | 44,900 | 18,308 | 40.8 | 495,119 |
| % Change | +3.0 | +8.3 | - | +0.7 | +5.2 | - | +4.6 | +5.8 | - | +5.2 | +4.5 | - | +6.9 | +4.5 | - | +7.1 |
| 1990 | 1,214,484 | 337,240 | 27.8 | 240,616 | 115,240 | 47.9 | 43,645 | [illegible],387 | 14.6 | 70,935 | 45,548 | 64.2 | 47,871 | 19,091 | 39.9 | 523,506 |
| % Change | +2.8 | +5.9 | - | +0.2 | +3.2 | - | +4.9 | -5.5 | - | +4.6 | +4.3 | - | +6.6 | +4.3 | - | +5.1 |
| 1995 | 1,238,913 | 359,840 | 29.0 | 238,871 | 117,530 | 49.2 | 45,572 | [illegible],917 | 15.2 | 73,563 | 47,091 | 64.0 | 50,713 | 20,470 | 40.4 | 551,843 |

Table 2.FF - Population, 1950 - 2000[24] (Cont'd)

| | Erie County | | | Niagara County | | | Orleans County | | | Genesee County | | | Wyoming County | | | Tonawanda Co. Watershed (Total) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | County Total | County MCD's in Watershed | % of Co. Tot. in Watershed | County Total | County MCD' in Watershed | % of Co. Tot. in Watershed | County Total | County MCD's in Watershed | % of Co. Tot. in Watershed | County Total | County MCD's in Watershed | % of Co. Tot. in Watershed | County Total | County MCD's in Watershed | % of Co. Tot. in Watershed | |
| % Change | +2.0 | +6.7 | - | -0.7 | +2.0 | - | +4.4 | +8.3 | - | +3.7 | +3.4 | - | +5.9 | +7.2 | - | +5.4 |
| 2000 | 1,256,954 | 378,535 | 30.1 | 236,129 | 119,655 | 50.7 | 47,377 | 7,447 | 15.7 | 75,709 | 48,634 | 64.2 | 53,467 | 21,843 | 40.9 | 576,164 |
| % Change | +1.5 | +5.2 | - | -1.2 | +1.8 | - | +4.0 | +7.7 | - | +2.9 | +3.3 | - | +6.4 | +6.7 | - | +4.4 |

Note: The watershed in each county is defined as the total population in all cities, towns, and villages that are completely or partially within the watershed's bound.

Table 2.GG - Economic Projections, 1970 - 2020[25], [26]

| | Per Capita Income (1967 $) | | Total Employment | | Total Personal Income (Thousands 1967 $) | |
|---|---|---|---|---|---|---|
| | Upstream Region | Downstream Region | Upstream Region | Downstream Region | Upstream Region | Downstream Region |
| 1970 | 3,199 | 3,569 | 52,965 | 515,261 | 457,536 | 4,820,299 |
| 1980 | 4,400 | 4,900 | 59,900 | 559,900 | 649,300 | 6,524,300 |
| % Change | +37.5 | +37.3 | +13.1 | +8.7 | +41.9 | +35.4 |
| 1985 | 5,000 | 5,600 | 61,100 | 573,700 | 750,700 | 7,553,400 |
| % Change | +13.6 | +14.3 | +2.0 | +2.5 | +15.6 | +15.8 |
| 1990 | 5,800 | 6,300 | 62,300 | 587,900 | 867,900 | 8,744,800 |
| % Change | +16.0 | +12.5 | +2.0 | +2.5 | +15.6 | +15.8 |
| 2000 | 7,800 | 8,400 | 66,400 | 634,400 | 1,187,400 | 12,031,400 |
| % Change | +34.5 | +33.3 | +6.6 | +7.9 | +36.8 | +37.6 |
| 2020 | 12,900 | 13,700 | 69,000 | 677,700 | 2,039,060 | 20,993,200 |
| % Change | +65.4 | +63.1 | +3.9 | +6.8 | +71.7 | +74.5 |

Notes: Upstream region is Genesee, Wyoming, and Allegany Counties. Downstream region is Erie and Niagara Counties.

Table 2.EE - Projections of Recreating Populations, 1970 - 1990[27]

| Picnicking | Erie County | Niagara County | Orleans County | Genesee County | Wyoming County | Tonawanda Ck. Region Total |
|---|---|---|---|---|---|---|
| 1970 | 504,083 | 112,815 | 16,460 | 27,641 | 17,627 | 678,626 |
| 1990 | 555,904 | 121,435 | 20,687 | 33,385 | 21,146 | 752,557 |
| % Change | +10.3 | +7.6 | +25.7 | +20.8 | +20.0 | +10.9 |

| Camping | Erie County | Niagara County | Orleans County | Genesee County | Wyoming County | Tonawanda Ck. Region Total |
|---|---|---|---|---|---|---|
| 1970 | 113,381 | 24,435 | 3,982 | 6,667 | 4,156 | 152,621 |
| 1990 | 130,073 | 26,874 | 5,087 | 8,074 | 5,018 | 175,126 |
| % Change | +14.7 | +10.0 | +27.8 | +21.1 | +20.7 | +14.8 |

| Hunting | Erie County | Niagara County | Orleans County | Genesee County | Wyoming County | Tonawanda Ck. Region Total |
|---|---|---|---|---|---|---|
| 1970 | 105,360 | 25,230 | 4,417 | 6,688 | 4,641 | 146,336 |
| 1990 | 107,859 | 24,135 | 5,066 | 7,209 | 4,813 | 149,082 |
| % Change | +2.4 | -4.3 | +14.7 | +7.8 | +3.7 | +1.9 |

| Fishing | Erie County | Niagara County | Orleans County | Genesee County | Wyoming County | Tonawanda Ck. Region Total |
|---|---|---|---|---|---|---|
| 1970 | 205,397 | 45,158 | 7,481 | 11,695 | 7,605 | 277,336 |
| 1990 | 220,664 | 47,569 | 9,144 | 13,587 | 9,222 | 300,186 |
| % Change | +7.4 | +5.3 | +22.2 | +16.2 | +21.3 | +8.2 |

## BIBLIOGRAPHY


1. The University of the State of New York. Geology of New York - a short account. (Adapted from the text of "Geologic Map of New York State" by J. G. Broughton, D. W. Fisher, V. W. Isachsen, L. V. Rickard) The University of the State of New York/State Education Department, New York State Museum and Science Service, Albany, NY 1966

2. Erie County Department of Health. 1974 Annual Report. Air Pollution Control Division Erie County Department of Health, Buffalo, NY.

3. La Sala, Jr., A. M. Ground-Water Resources of the Erie-Niagara Basin. New York. Prepared for the Erie-Niagara Basin Regional Water Resources Planning Board. U. S. Department of the Interior Geological Survey in cooperation with the New York State Conservation Department Division of Water Resources. Albany: State of New York Conservation Department Water Resources Commission. 1968.

4. NYS Department of Environmental Conservation. Twelve Month Statistical Summary - Sampling Period 1/74 - 12/74. NYS Department of Environmental Conservation, Division of Air Resources. Albany, NY. May 26, 1975.

5. USDA. SOIL SURVEY Genesee County, New York. United States Department of Agriculture, Soil Conservation Service in cooperation with Cornell University Agricultural Experiment Station. March 1969.

6. Beardslee, C. S. and H. D. Mitchell. Birds of the Niagara Frontier Region. Buffalo, New York: Bulletin of the Buffalo Society of Natural Sciences. Volume 22. 1965.

7. Mitchell, H. D. and R. F. Anderle. Birds of the Niagara Frontier Region Supplement. Buffalo, New York: Society of Natural Sciences, Volume 22, Supplement. 1970.

8. USDI. Threatened Wildlife of the United States. United States Department of the Interior, Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife. Washington, D.C. March 1973.

9. USDI. United States List of Endangered Fauna. United States Department of the Interior, Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife. Washington, D. C. May 1974.

10. Conant, Roger. A Field Guide to Reptiles and Amphibians of Easter North America. Houghton Mifflin Company, Boston. 1958.

11. NYS Department of Environmental Conservation. Classifications and Standards Governing The Quality and Purity of Waters of New York State. New York State Department of Environmental Conservation. Albany, NY. 27 March 1974.

12. Personal communication with the Sanitary Engineering Department, New York State Department of Environmental Conservation on 24 October 1975.

13. Personal communication with the Sanitary Engineering Department, New York State Department of Environmental Conservation on 8 December 1975.

14. Barry, David E. and Ronald D. Koczaja. Stream Survey 1970. Buffalo: Erie County Department of Health, 1970.

15. Puleo, Dr. Joseph; Mathew C. Lanighan and Charles O. Masters. 1973 Erie County Stream Survey. Buffalo: Public Health Division, Erie County Laboratory, 2100 City Hall, March 1973.

16. U. S. Geological Survey Data - Storete retrieval date 75/12/17.

17. U. S. Department of the Interior, Geological Survey, Central Laboratory, Albany, New York.

18. Marcus, Bernard A. and Frank J. Little, Jr. A Biological Survey of the Tonawanda Creek Relative to a Proposal of Impoundment. The Proceedings of the Rochester (New York) Academy of Science, Vol. 12, No. 3. March, 1974.

19. New York State Office of Planning Services. 1970 Socio-Economic Profiles Fourth Count Census. New York State Office of Planning Services (1973).

20. New York State Department of Commerce. Buffalo Area Business Fact Book, Part 1, Business and Manufacturing. Albany: New York State Department of Commerce (1972).

21. New York State Department of Commerce. Rochester Area Business Fact Book, Part 1, Business and Manufacturing. Albany: New York State Department of Commerce (1972).

22. U. S. Bureau of the Census. 1969 Census of Agriculture. U. S. Government Printing Office (1971).

23. New York State Office of Parks and Recreation. New York State Outdoor Recreation Facilities Inventory. New York State Office of Parks and

24. New York State Office of Planning Services data as presented from the following sources:

a. New York State Office of Planning Services. Demographic Projections, Genesee-Finger Lakes Region 7 and Western Region 11. New York State Office of Planning Services (1974).

b. Erie and Niagara Counties Regional Planning Board. Regional Population Projections. Erie and Niagara Counties Regional Planning Board (1972).

c. Niagara Mohawk Power Corporation. "Orleans County Population Projections," Niagara Mohawk Power Corporation.

d. Personal communication with the Planner, Genesee County Department of Planning, 7 January 1975.

e. Teetor - Dobbins Consulting Engineers. Wyoming County Sewerage Study. Wyoming County (1970).

25. U. S. Water Resources Council. 1972 OBERS Projections, Volume 5, Standard Metropolitan Statistical Areas. U. S. Water Resources Council (1974).

26. U. S. Water Resources Council. 1972 OBERS Projections, Volume 7, Non-SMSA Portions of Water Resources Subareas. U. S. Water Resources Council (1974).

27. New York State Office of Parks and Recreation. Forecast of Outdoor Recreation in New York State, 1970-1990. New York State Office of Parks and Recreation (1973).

28. Genesee County Department of Planning. County Concept Emerging Open Space-Recreation Plan. Genesee County Planning Board, Genesee County Planning Department, 3837 W. Main Street Road, Batavia, New York 14020. December, 1974.

29. U. S. Army Corps of Engineers. Buffalo Metropolitan Area, New York Water Resources Management - Interim Report on Feasibility of Flood Management in Tonawanda Creek Watershed (Final Feasibility Report) - Main Report. U. S. Army Corps of Engineers, Buffalo, New York (1976).

APPENDIX F

# CULTURAL RESOURCES

The Buffalo District contracted ith the Department of Anthropology of the State University of New York at Binghampton, during the summer of 1979, to conduct a Phase I archaeological reconnaissance of the Batavia Reservoir Compound area. The Phase I report has been coordinated with the State Historic Preservation Officer (SHPO), the New York State Archaeologist and the Heritage Conservation and Recreation Service. Letters of coordination are printed on the next few pages.

Copies of the report entitled "Batavia Reservoir Compound Phase I Archaeological Summary" by J. Terrence McCabe and A. Peter Mair III, et. al. are available through the National Technical Information Service, U.S. Department of Commerce, Springfield VA 22161.

NCBED-PE 17 October 1980

Dr. Robert Funk
State Archaeologist
University of the State
of New York
State Education Department
Cultural Education Center
Albany, NY 12230

Dear Dr. Funk:

Enclosed for your information is a Final Cultural Resources Report entitled, Batavia Reservoir Compound: Phase I Archaeological Summary and Appendicies.

If you have any questions regarding this report, please contact Mr. Richard H. Lewis, Staff Archaeologist, at (716) 876-5454, extension 2175.

Sincerely,

3 Incl
as stated

DONALD M. LIDDELL
Chief, Engineering Division

CF:
NCBED-PE

Lewis______
Berkeley____
Bennett_____
Pieczynski__
Hallock_____
Liddell_____

NCBED-PE 17 October 1980

Ms. Ann Webster Smith
Deputy Commissioner for
Historic Preservation
New York State Office of
Parks and Recreation
Agency Building #1
Empire State Plaza
Albany, NY 12338

Dear Ms. Smith:

Enclosed for your information is a Final Cultural Resources Report entitled, Batavia Reservoir Compound: Phase I Archaeological Summary and Appendicies.

If you have any questions regarding this report, please contact Mr. Richard H. Lewis, Staff Archaeologist, at (716) 876-5454, extension 2175.

Sincerely,

3 Incl
as stated

DONALD M. LIDDELL
Chief, Engineering Division

CF:
NCBED-PE

Lewis______
Berkeley____
Bennett_____
Pieczynski__
Hallock_____
Liddell_____

NCBED-PE 17 October 1980

Dr. Bennie Keel
Departmental Consulting Archaeologist
Heritage Conservation and
Recreation Service
U. S. Department of the Interior
Washington, DC 20243

Dear Dr. Keel:

Enclosed for your information is a Final Cultural Resources Report entitled, Batavia Reservoir Compound: Phase I Archaeological Summary and Appendicies.

If you have any questions regarding this report, please contact Mr. Richard H. Lewis, Staff Archaeologist, at (716) 876-5454, extension 2175.

Sincerely,

2 Incl
as stated

DONALD M. LIDDELL
Chief, Engineering Division

CF:
NCBED-PE

Lewis______
Berkeley____
Bennett_____
Pieczynski___
Hallock_____
Liddell_____

NCBED-PE 17 October 1980

Mrs. Myra Harrison
Division of Archaeology
Heritage Conservation and
Recreation Service
William J. Green Federal Building
600 Arch Street
Room 9310
Philadelphia, PA 19106

Dear Ms. Harrison:

Enclosed for your information is a Final Cultural Resources Report entitled, Batavia Reservoir Compound: Phase I Archaeological Summary and Appendicies.

If you have any questions regarding this report, please contact Mr. Richard H. Lewis, Staff Archaeologist, at (716) 876-5454, extension 2175.

Sincerely,

2 Incl
as stated

DONALD M. LIDDELL
Chief, Engineering Division

CF:
NCBED-PE

Lewis______
Berkeley____
Bennett_____
Pieczynski__
Hallock_____
Liddell_____

NCBED-PE

17 October 1980

Defense Technical Information Center
ATTN: DTIS/DDA-2/Paul F. Cooper
Alexandria, VA 22314

Dear Mr. Cooper:

Enclosed are 12 copies of the report entitled, "Batavia Reservoir Compound Archaeological Summary," and appendicies. Please make the necessary arrangements to have this report and appendicies available from the National Technical Information Service, Springfield, VA.

If you require any further input, please feel free to contact me at the above address.

Sincerely,

1 Incl (12 cys)
as stated

THOMAS VAN WART
District Librarian

CF:
NCBED-PE

Lewis______
Berkeley______
Bennett______
VanWart______

**United States Department of the Interior**
HERITAGE CONSERVATION AND RECREATION SERVICE
SOUTHEAST REGIONAL OFFICE
75 Spring Street S.W., Suite 1176
Atlanta, Georgia 30303

IN REPLY REFER TO:
W540

JUL 15 1980

Mr. Richard H. Lewis
Buffalo District, Corps
of Engineers
1776 Niagara Street
Buffalo, New York 14207

Dear Mr. Lewis:

Due to staff reductions within the Office of Interagency Archeological Services-Atlanta, we are unable to review the report "Batavia Reservoir Compound, Phase I Archeological Survey." We will be happy to continue to receive reports for review from your office and will notify you on an as received basis which ones we will review. If you have any questions, please contact Mr. James Thomson at (404) 221-2633.

Sincerely,

Victor A. Carbone
Acting Chief

NEW YORK STATE PARKS & RECREATION Agency Building 1 Empire State Plaza Albany New York 12238 Information 518 474
Orin Lehman, Commissioner

June 27, 1980

Mr. Donald Liddell
Chief, Engineering Division
Dept. of the Army
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, N.Y. 14207

Dear Mr. Liddell:

Batavia Reservoir Compound
Genesee County, New York

We have reviewed the cultural resource reconnaissance report on this project and wish to make a few comments. The survey seems to be complete and the recommendations are in order. However, the structure survey forms do not provide sufficient information for us to evaluate them. The contact prints are not adequate particularly in cases where the structure may well be eligible for the National Register. Photos should be attached to the form as indicated on the form and in the enclosed manual. Also, an overall map should be included with forms keyed to it. This can be a USGS map if scale is a problem. We suggest you have your consultants follow the instructions in the manual for architectural and historical information as well.

Due to the large number of structures included in this study, it may be beneficial to wait until you know which structures are to be affected before a detail study is made.

Please call Bruce Fullem at 518-474-3176 should you wish to discuss this matter in detail.

Sincerely,

Stephen J. Raiche
Director
Historic Preservation Field
Services

NCD COPS
Checked by SL
Filed by

BF:mr

Enc.

NCBED-PE 9 June 1980

Dr. Robert Funk, State Archaeologist
New York State Museum and Science Service
Anthropological Survey
Albany, NY 12234

Dear Dr. Funk:

Enclosed for your review and comment is a cultural resources reconnaissance report entitled "Batavia Reservoir Compound, Phase I Archaeological Summary" prepared for the Buffalo District by the State University of New York at Binghamton. This report is an update (which was required by project changes) of the cultural resourses report provided for your review in November 1979.

If we do not receive your comments within 30 days of your receipt of this letter, we will assume you are in agreement with the contents of the report. Comments received after the expiration of the comment period cannot be considered in the preparation of the final report.

If you have any questions regarding this matter, please contact my staff Archaeologist, Mr. Richard H. Lewis at (716) 876-5454, extension 2171.

Sincerely,

DONALD M. LIDDELL
Chief, Engineering Division

CF:
√NCBED-PE

Lewis__________
Berkeley__________
Bennett__________
Pieczynski__________
Hallock__________
Liddell__________

NCBED-PE

9 June 1980

Dr. Stephanie H. Rodeffer, Acting Chief
Interagency Archaeological Services - Atlanta
Heritage Conservation and Recreation Service
Richard B. Russel Federal Building
75 Spring Street
Atlanta, GA 30303

Dear Dr. Rodeffer:

Enclosed for your review and comment is a cultural resources reconnaissance report entitled "Batavia Reservoir Compound, Phase I Archaeological Summary" prepared for the Buffalo District by the State University of New York at Binghamton. This report is an update (which was required by project changes) of the cultural resourses report provided for your review in November 1979.

If we do not receive your comments within 30 days of your receipt of this letter, we will assume you are in agreement with the contents of the report. Comments received after the expiration of the comment period cannot be considered in the preparation of the final report.

If you have any questions regarding this matter, please contact my staff Archaeologist, Mr. Richard H. Lewis at (716) 876-5454, extension 2171.

Sincerely,

DONALD M. LIDDELL
Chief, Engineering Division

CF:
NCBED-PE

Lewis________
Berkeley________
Bennett________
Pieczynski________
Hallock________
Liddell________

NCBED-PE 9 June 1980

Dr. Ann Webster-Smith, Deputy Commissioner
for Historic Preservation
Division for Historic Preservation
New York State Office of Parks and
Recreation
Agency Building No. 1
Empire State Plaza
Ablany, NY 12238

Dear Dr. Webster-Smith:

Enclosed for your review and comment is a cultural resources reconnaissance report entitled "Batavia Reservoir Compound, Phase I Archaeological Summary" prepared for the Buffalo District by the State University of New York at Binghamton. This report is an update (which was required by project changes) of the cultural resourses report provided for your review in November 1979.

If we do not receive your comments within 30 days of your receipt of this letter, we will assume you are in agreement with the contents of the report. Comments received after the expiration of the comment period cannot be considered in the preparation of the final report.

If you have any questions regarding this matter, please contact my staff Archaeologist, Mr. Richard H. Lewis at (716) 876-5454, extension 2171.

Sincerely,

DONALD M. LIDDELL
Chief, Engineering Division

CF:
NCBED-PE

Lewis__________
Berkeley__________
Bennett__________
Pieczynski__________
Hallock__________
Liddell__________

# TELEPHONE OR VERBAL CONVERSATION RECORD

For use of this form, see AR 340-15; the proponent agency is The Adjutant General's Office.

DATE: 4January 1980

SUBJECT OF CONVERSATION
Letter from The New York State Historic Preservation Office Regarding the Batavia Reservoir Compound Phase I Archaeological Summary.

INCOMING CALL

| PERSON CALLING | ADDRESS | PHONE NUMBER AND EXTENSION |
|---|---|---|
| | | |
| PERSON CALLED | OFFICE | PHONE NUMBER AND EXTENSION |
| | | |

OUTGOING CALL

| PERSON CALLING | OFFICE | PHONE NUMBER AND EXTENSION |
|---|---|---|
| Richard H.Lewis | NCBED-PE | FTS 4732171 |
| PERSON CALLED | ADDRESS | PHONE NUMBER AND EXTENSION |
| Bruce Fullem | NYSHPO | FTS 456-3176 |

SUMMARY OF CONVERSATION

Mr. Fullem was called in order to explain how the Buffalo District was planning to handle the data deficiencies in the above referenced report. It was explained that a contract modification was being considered that would require the contractor to survey those portions of the project area which were not included in the initial scope of work. In addition it would be required that the contractor fill out the Building-Structure Inventory Form, which is required by the state, for each structure which would be affected by the project. Mr Fullem indicated that this approach would satisfy the concerns of the SHPO.

Richard H. Lewis
Richard H.Lewis
Archaeologist
Environmental Resources Section

CF:
NCBED-P
NCBED-PN
NCBED-PE

DA FORM APR 66 751 REPLACES EDITION OF 1 FEB 58 WHICH WILL BE USED.

NEW YORK STATE PARKS & RECREATION Agency Building 1 Empire State Plaza Albany, New York 12238 Information 518 474-0456
Orin Lehman, Commissioner

December 21, 1979

Kenneth R. Hallock
Acting Chief, Engineering Division
Department of the Army
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Attention: Richard Lewis

Gentlemen:

"Batavia Reservoir Compound Phase I
Archaeological Summary"
Batavia Reservoir Compound
Tonawanda Creek, between Alexander and
Batavia
Genesee County

Thank you for consulting with the State Historic Preservation Officer (SHPO) concerning the above-referenced report.

It is the opinion of the SHPO that the report represents a professional effort, and that the further archeological investigation that is recommended should be undertaken. Further, we understand that the nature and scope of the project have changed a bit recently, and that we do not have a current assessment of what specific structures may be affected by the proposed undertaking. When you have determined what structures may be affected, please provide us with additional information on each so that our office can provide you with additional comments. For each structure, we request:

1. mapped location (one master map could also be used)
2. original photograph
3. blue building/structure inventory form (see enclosed sample)
4. description of potential effect upon building.

If you should have any questions, please contact the project review staff at 518-474-3176.

Sincerely,

STATE HISTORIC PRESERVATION OFFICER

By Stephen J. Raiche, Director
Historic Preservation Field
Services

LRK:mr
Enc.

# TELEPHONE OR VERBAL CONVERSATION RECORD

For use of this form, see AR 340-15; the proponent agency is The Adjutant General's Office.

**DATE:** 12 December 1979

**SUBJECT OF CONVERSATION**

Review of the Cultural Resources Report for the Batavia Reservoir Compound by the Interagency Archaeological Services (IAS)

**INCOMING CALL**

| PERSON CALLING | ADDRESS | PHONE NUMBER AND EXTENSION |
|---|---|---|
| | | |

| PERSON CALLED | OFFICE | PHONE NUMBER AND EXTENSION |
|---|---|---|
| | | |

**OUTGOING CALL**

| PERSON CALLING | OFFICE | PHONE NUMBER AND EXTENSION |
|---|---|---|
| Richard H.Lewis | NCBED-PE | |

| PERSON CALLED | ADDRESS | PHONE NUMBER AND EXTENSION |
|---|---|---|
| Jim Thompson | IAS | |

**SUMMARY OF CONVERSATION**

Mr.Thompson was called in order to find out if IAS was planning to comment on the subject report. He indicated that they were not.

Richard H. Lewis

Richard H.Lewis
Archaeologist
Environmental Resources Section

DA FORM 1 APR 66 751 REPLACES EDITION OF 1 FEB 58 WHICH WILL BE USED.

# TELEPHONE OR VERBAL CONVERSATION RECORD

For use of this form, see AR 340-15; the proponent agency is The Adjutant General's Office.

| | | |
|---|---|---|
| **DATE** | 10 December 1979 | |
| **SUBJECT OF CONVERSATION** | Review of the Cultural Resources Report for the Batavia Reservoir Compound by the Office of the State Archaeologist (OSA) | |
| **INCOMING CALL** | | |
| **PERSON CALLING** | **ADDRESS** | **PHONE NUMBER AND EXTENSION** |
| | | |
| **PERSON CALLED** | **OFFICE** | **PHONE NUMBER AND EXTENSION** |
| | | |
| **OUTGOING CALL** | | |
| **PERSON CALLING** | **OFFICE** | **PHONE NUMBER AND EXTENSION** |
| Richard H.Lewis | NCBED-PE | |
| **PERSON CALLED** | **ADDRESS** | **PHONE NUMBER AND EXTENSION** |
| Phil Lord | OSA | |

**SUMMARY OF CONVERSATION**

Mr. Lord was called in order to find out if the OSA was planning to comment on the subject report. He indicated that his office did review the report but was not going to submitt written comments.

Richard H.Lewis
Archaeologist
Environmental Resources Section

## TELEPHONE OR VERBAL CONVERSATION RECORD

For use of this form, see AR 340-15; the proponent agency is The Adjutant General's Office.

| DATE |
|---|
| 10 December 1979 |

**SUBJECT OF CONVERSATION**

Review of the Cultural Resources Report for the Batavia Reservoir Compound by the New York State Historic Preservation Office (NYSHPO)

**INCOMING CALL**

| PERSON CALLING | ADDRESS | PHONE NUMBER AND EXTENSION |
|---|---|---|
| | | |
| **PERSON CALLED** | **OFFICE** | **PHONE NUMBER AND EXTENSION** |
| | | |

**OUTGOING CALL**

| PERSON CALLING | OFFICE | PHONE NUMBER AND EXTENSION |
|---|---|---|
| Richard H.Lewis | NCBED-PE | FTS 4732171 |
| **PERSON CALLED** | **ADDRESS** | **PHONE NUMBER AND EXTENSION** |
| Lenore Kuwik | NYSHPO | FTS 5643176 |

**SUMMARY OF CONVERSATION**

Ms. Kuwik was called to find out the status of the subject report in the NYSHPO'S review process and to find out if the comments which we requested would be recieved within the 30 day review pereid.

She indicated that the report had been circulated and the review about 50% completed, however it did not appear that the comments would be submitted to Buffalo District within the review pereid. She fúrter indicated that the comments should be recieved by 30 December 1979.

Richard H.Lewis
Archaeologist
Environmental Resources Section

DA FORM 751, APR 66 — REPLACES EDITION OF 1 FEB 58 WHICH WILL BE USED.

NCBED-PE

13 November 1979

Mr. Bruce Fullen
Office of Orin Lehman, Commissioner
State Historic Preservation Officer
Division for Historic Preservation
New York State Office of Parks
and Recreation
Agency Building, 1 Empire State Plaza
Albany, NY 12238

Dear Mr. Fullen:

Enclosed for your review and comment is a report entitled "Batavia Reservoir Compound Phase I Archaeological Summary." This report was undertaken in partial fulfillment of E. O. 11593 and the National Historic Preservation Act.

If we do not receive your comments within 30 days of your receipt of this letter, we will assume you are in agreement with the contents of the report.

If you have any questions regarding this action, please contact staff archaeologist, Richard H. Lewis at (716) 876-5454, ext. 2171.

Thank you for your consideration in this matter.

Sincerely,

1 Incl
as stated

KENNETH R. HALLOCK
Acting Chief, Engineering Division

CF:
NCBED-PE

Lewis________
Berkeley______
Bennett______
Gilbert______
Hallock______

NCBED-PE 13 November 1979

Robert Funk, State Archaeologist
New York State Museum and Science Service
Anthropological Survey
Albany, NY 12234

Dear Mr. Funk:

Enclosed for your review and comment is a report entitled "Batavia Reservoir Compound Phase I Archaeological Summary." This report was undertaken in partial fulfillment of E. O. 11593 and the National Historic Preservation Act.

If we do not receive your comments within 30 days of your receipt of this letter, we will assume you are in agreement with the contents of the report.

If you have any questions regarding this action, please contact staff archaeologist, Richard H. Lewis at (716) 876-5454, ext. 2171.

Thank you for your consideration in this matter.

Sincerely,

1 Incl
as stated

KENNETH R. HALLOCK
Acting Chief, Engineering Division

CF:
NCBED-PE

Lewis________
Berkeley______
Bennett_______
Gilbert_______
Hallock_______

NCBED-PE 13 November 1979

Bennie Keel, Chief
Interagency Archaeological
Services - Atlanta
Heritage Conservation and
Recreation Service
Richard Brussel Federal Building
75 Spring Street
Atlanta, GA 30303

Dear Mr. Keel:

Enclosed for your review and comment is a report entitled "Batavia Reservoir Compound Phase I Archaeological Summary." This report was undertaken in partial fulfillment of E. O. 11593 and the National Historic Preservation Act.

If we do not receive your comments within 30 days of your receipt of this letter, we will assume you are in agreement with the contents of the report.

If you have any questions regarding this action, please contact staff archaeologist, Richard H. Lewis at (716) 876-5454, ext. 2171.

Thank you for your consideration in this matter.

Sincerely,

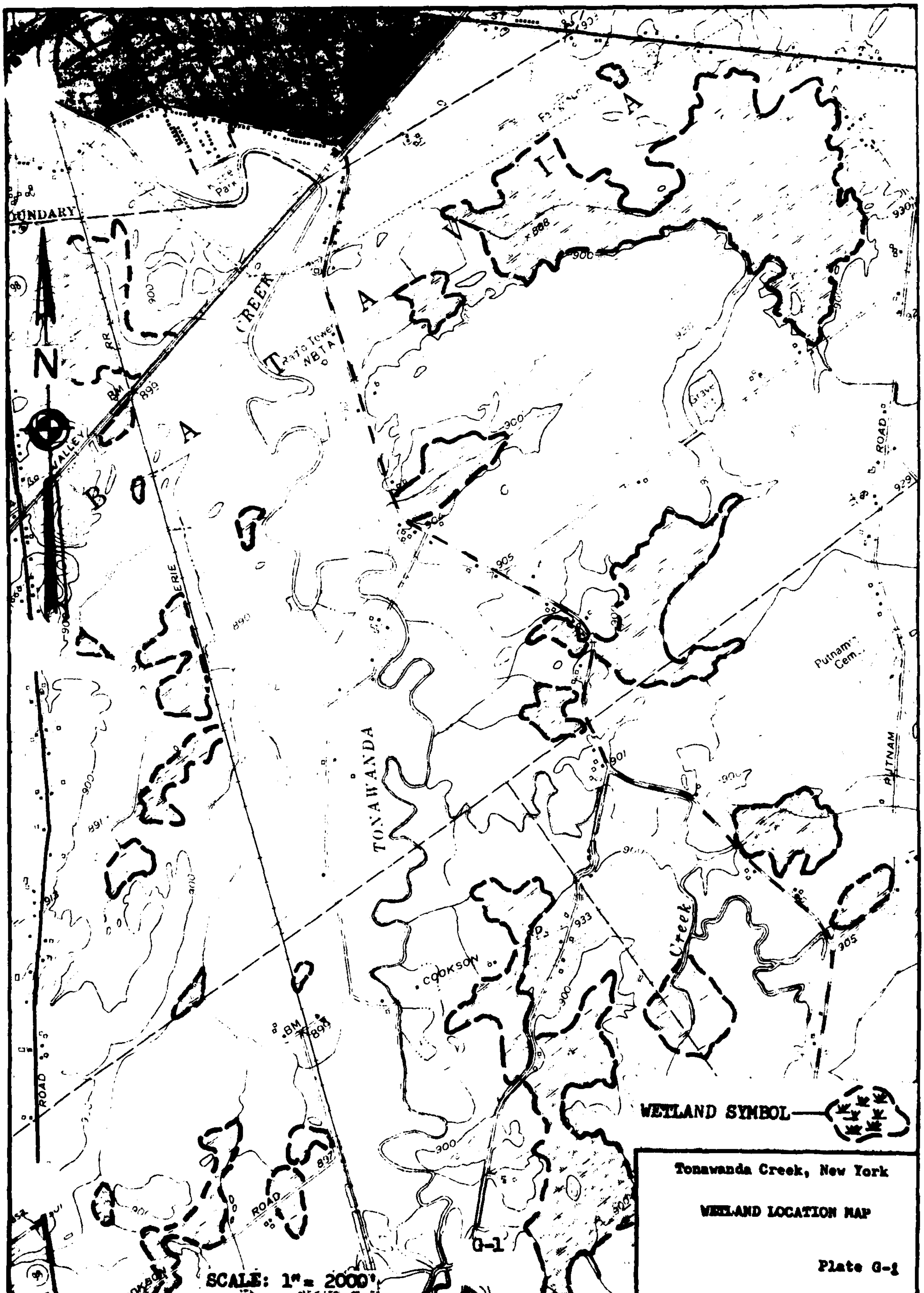
KENNETH R. HALLOCK
Acting Chief, Engineering Division

1 Incl
as stated
CF:
NCBED-PE

Lewis________
Berkeley______
Bennett_______
Gilbert_______
Hallock_______

# APPENDIX G

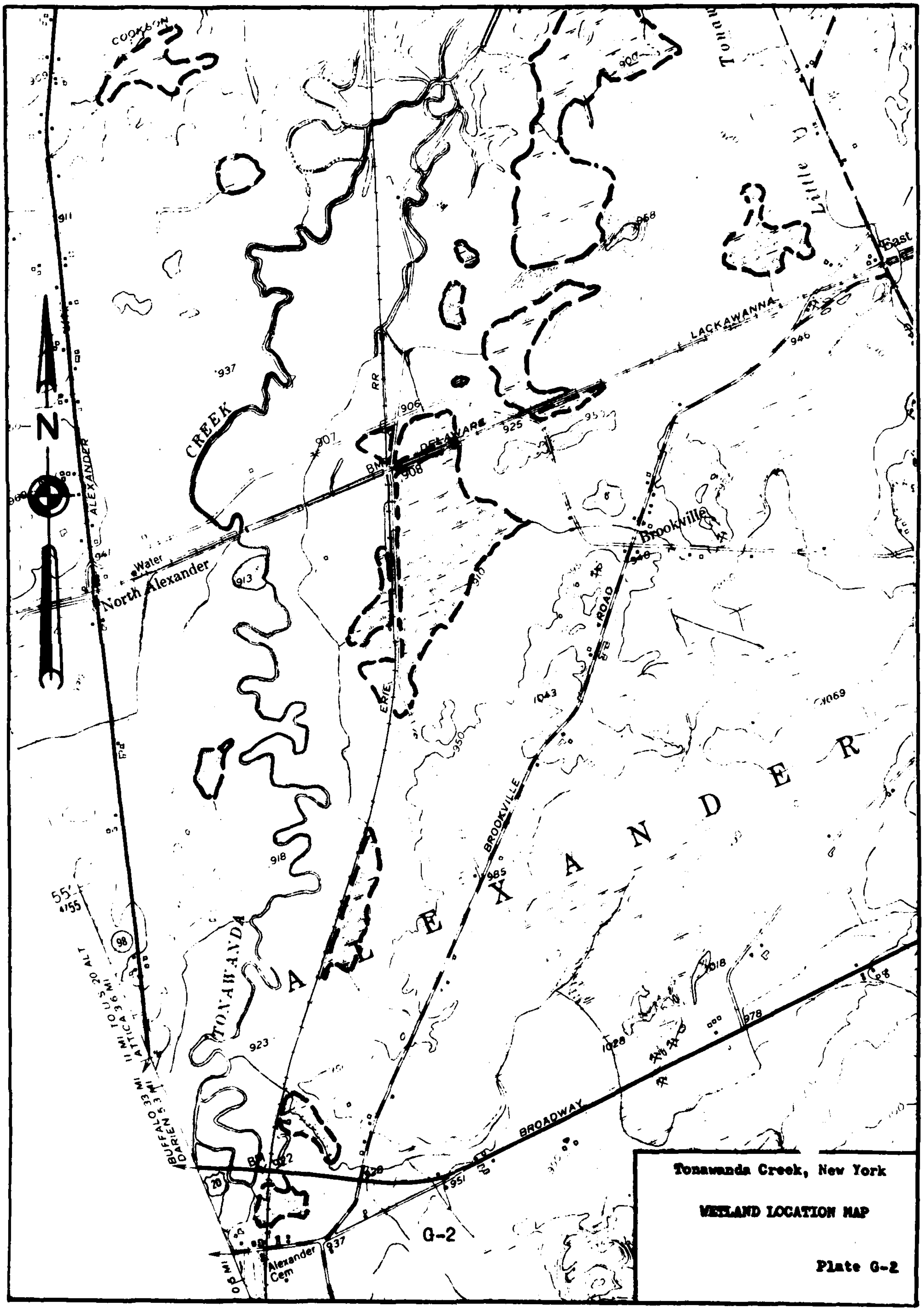
# WETLAND LOCATION MAPS




Tonawanda Creek, New York

WETLAND LOCATION MAP

Plate G-1



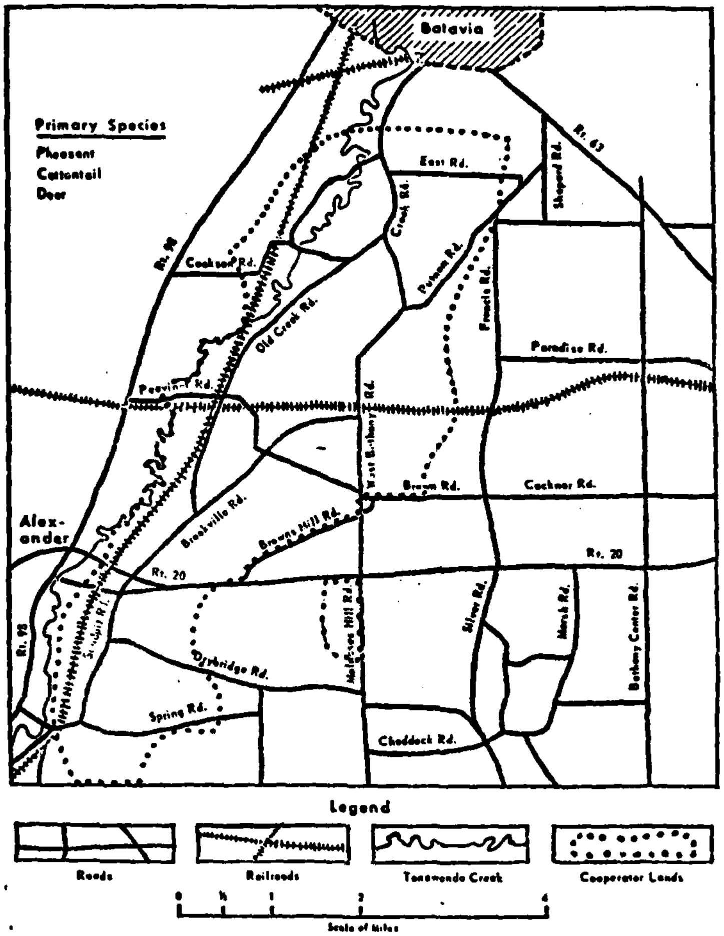

**Tonawanda Creek, New York**

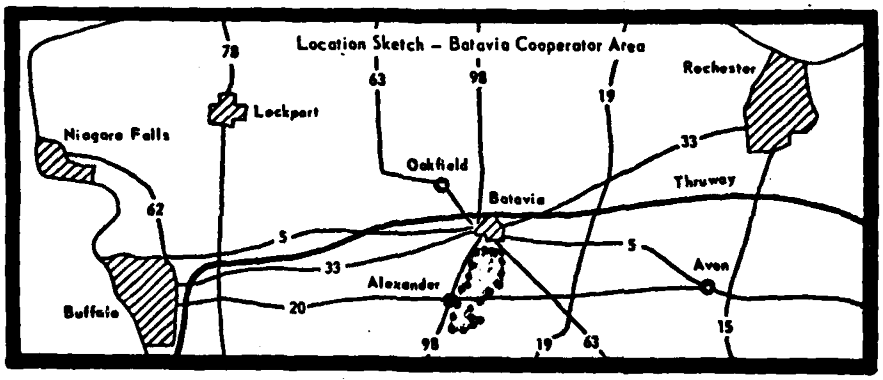
**WETLAND LOCATION MAP**

**Plate G-2**

# APPENDIX H

## RECREATION MAPS OF THE GENESEE COUNTY PARK AND FOREST, AND THE BATAVIA COOPERATIVE HUNTING AREA

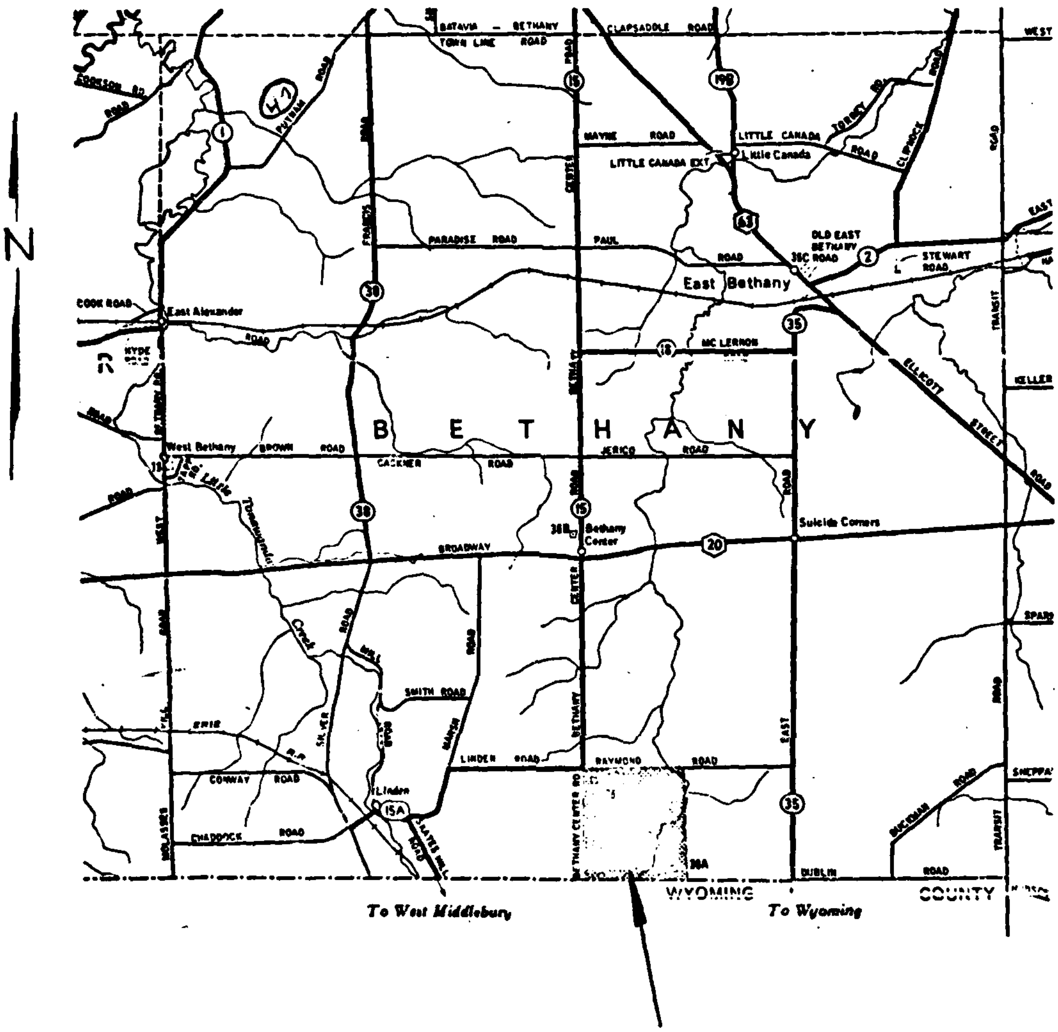



Tonawanda Creek, New York

GENERAL LOCATION MAP
of the
Batavia Cooperative Hunting Area

Plate H-1




Park location

| Tonawanda Creek, New York |
|---|
| GENESEE COUNTY PARK AND FOREST<br>in the Town of Bethany |
| Plate H-2 |

Scale: 1" = 1 Mile

# APPENDIX I

## GLOSSARY OF TERMS

## GLOSSARY OF TERMS

ALGAE - Any of a group of chiefly marine or freshwater chlorophyll bearing aquatic plants with no true leaves, stems or roots. Ranging from microscopic single-cell organisms or colonies to large macroscopic seaweeds, etc.

AQUATIC - Growing, living in, frequenting or pertaining to marine or freshwater.

AQUATIC EMERGENT VEGETATION - Aquatic plants, usually rooted, which during part of their cycle have portions above water.

AQUATIC SUBMERGENT VEGETATION - Aquatic plants adapted to grow under water.

BENTHIC - Of/the bottom of lakes or oceans. Of/organisms which live on the bottom of water bodies.

BIOCHEMICAL OXYGEN DEMAND (BOD) - A measure of the amount of oxygen consumed in the biological processes that break down organic matter in water. Large amounts of organic waste use up large amounts of dissolved oxygen, thus the greater the degree of pollution, the greater the BOD.

DISSOLVED OXYGEN (DO) - The oxygen dissolved in water or sewage. Adequately dissolved oxygen is necessary for the life of fish and other aquatic organisms and for the prevention of offensive odors. Low dissolved oxygen concentrations generally are due to discharge of excessive organic solids having high BOD, the result of inadequate waste treatment.

ESCARPMENT - A long, precipitous clifflike ridge of land, rock, or the like, commonly formed by faulting or fracturing of the earth's crust.

FECAL COLIFORM BACTERIA - A group of organisms common to the intestinal tracts of man and of animals. The presence of fecal coliform bacteria in water is an indicator of pollution and potentially dangerous bacterial contamination.

FLOOD - A temporary rise in stream flow or stage that results in significant adverse effects in the vicinity under study.

FLOODPLAIN - The relatively flat low lands adjoining a watercourse or other body of water subject to overflow therefrom.

GEOLOGY - The study of the planet Earth. It is concerned with the origin of the planet, the material and morphology (form and structure) of the Earth, and its history and processes that acted upon it to affect its historic and present forms.

MACROINVERTEBRATE - In general, those groups of organisms lacking a backbone and internal skeleton, and which can be recognized without the use of a microscope.

MAXIMUM PROBABLE FLOOD - Is a flood of the greatest magnitude likely to occur.

RIPARIAN - Related to or living or located on the bank of a natural water course.

RIPRAP - A quantity of broken stone for foundations, revetments or embankments.

SIESMICITY - The frequency, intensity, and distribution of earthquakes in a given area.

SOIL TYPE - A phase of subdivision of a soil series based primarily on texture of the surface soil to a depth at least equal to plow depth (about 6 inches).

SPECIES (Both singular and plural) - An organism or organisms forming a natural population or group of populations that transmit specific characteristics from parent to off-spring. They are reproductively isolated from other populations with which they might breed.

STANDARD PROJECT FLOOD - The largest flood that can be expected from the most severe combination of meteorological and hydrological conditions that is considered reasonably characteristic of the geographical region involved.

TERRESTRIAL - Of/land, the continents, and/or dry ground; contrasted to aquatic.

TURBIDITY - Cloudy condition of water due to the suspension of silt or finely divided organic matter.

WATERSHED - The area drained by a given stream.

20-YEAR DEGREE FLOOD - Is a flood discharge expected to occur, on the average of once in 20 years.

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